MAY
1961

FOUNDRY

A PENTON PUBLICATION

A SPECIAL REPORT

Meeting Competition Through Improved . .

Foundry Technology

—Page 118

65th CASTINGS CONGRESS • AMERICAN FOUNDRYMEN'S SOCIETY • SAN FRANCISCO, MAY 8-12

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. . . If you have a Simpson Mix-Muller,
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***progressive* mechanization of your sand system.**
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*Engineers: Note outstanding yield strength.

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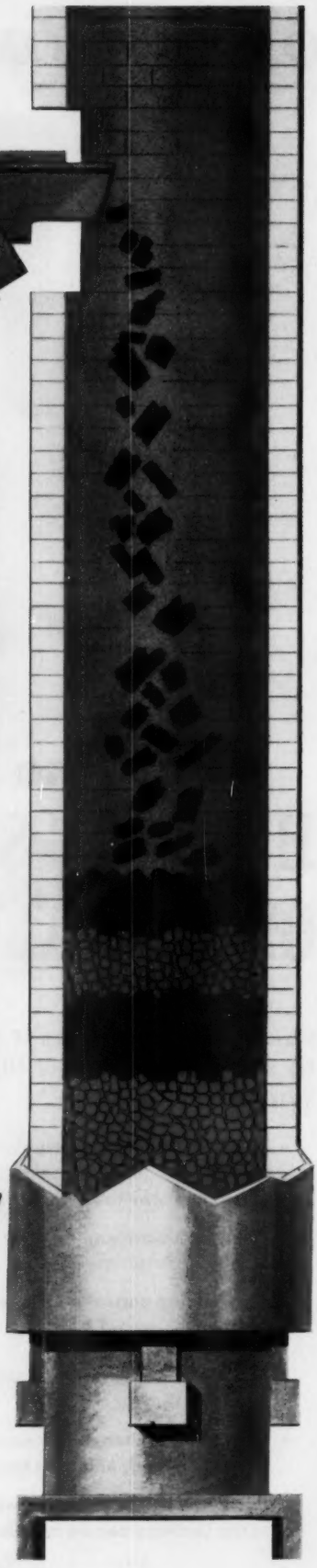

The Brown Cupoloader Charger has many features never before available in bucket-type charging equipment! Made of a shallow-pan rectangular design, it brings accurate control and cost savings to this critical foundry function.

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May 1961
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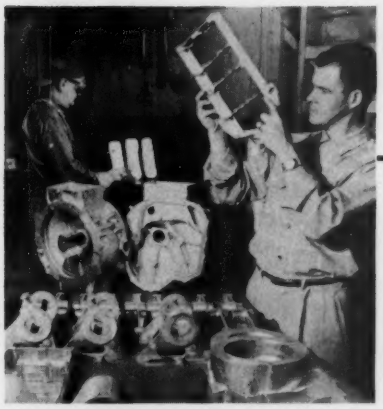

The aluminum sand foundry at the Industrial Products Div., Boeing Airplane Co., Seattle, is remarkable for the quality of its products. Here, an employee visually inspects some trimmed castings. In the foreground are turbine airflow controllers. See p. 194.

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FOUNDRY is edited primarily for management, production, technical, and purchasing personnel in foundries. A copy is sent at no cost to each metal casting plant in the U. S. and Canada employing 20 or more workers and to selected smaller foundries. Additional copies are sent to each foundry to the extent necessary to serve all key foundry personnel on a personal or routed basis. A limited number of copies is supplied at no cost to educational institutions. Subscriptions in the U. S., possessions, and Canada for home-addressed copies and copies not qualified for under the above principles: One year, $10. Single copy, $1. Other countries: One year, $20. Single copy, $2. Published monthly by The Penton Publishing Co., Penton Building, Cleveland 13, Ohio. Accepted as controlled circulation publication at Cleveland, Ohio.

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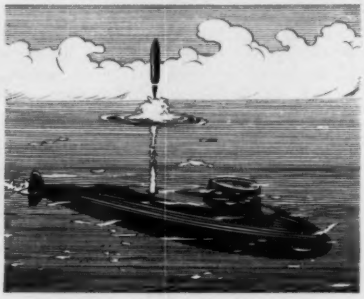
THE EDITORS' WORKSHOP

MARE ISLAND: Foundrymen attending the AFS Congress in San Francisco will be able to visit the oldest Naval establishment on the Pacific Coast on Thursday, May 11. Mare Island Naval Shipyard at nearby Vallejo, Calif., has built vessels since 1859, including more than 30



submarines. Currently it is working on the Polaris-firing sub *Theodore Roosevelt*. Spread over 2500 acres, the huge Yard includes a large foundry and pattern shop.

Just for the record, here's how Mare Island acquired its name. Gen. Mariano Guadalupe Vallejo, early California land baron, was transporting some livestock on a barge which overturned. A white mare managed to swim to the island. In recognition of the feat General Vallejo christened the island "Isla de la Yergue" or "Island of the Mare." The name stuck.

MACHINABILITY: How copper can eliminate hard spots and improve machinability of gray iron will be discussed in a coming article. Prepared by Prof. Albert De Sy and J. Van Eeghem of Belgium, the report is based on investigations conducted by Belgian research groups. It's a subject of considerable importance to both producers and users of gray iron castings.

COMING: Other subjects to be discussed in articles scheduled for coming months include Japanese production of high-strength cast iron, use of chills in the steel foundry, inventory scheduling, and planning for mass production.

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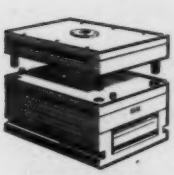

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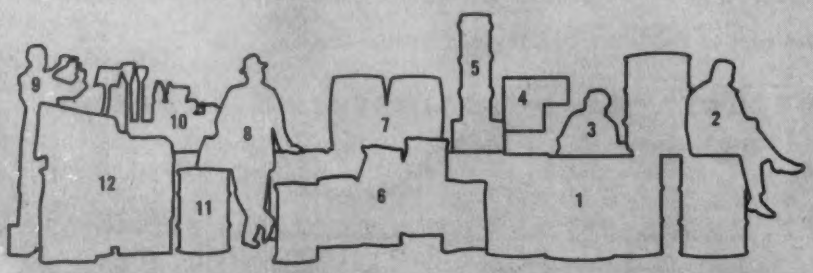

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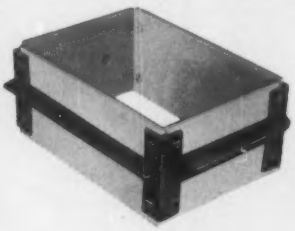

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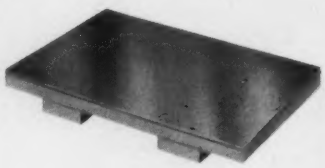

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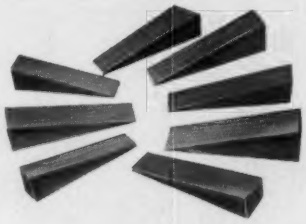

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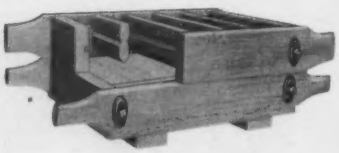

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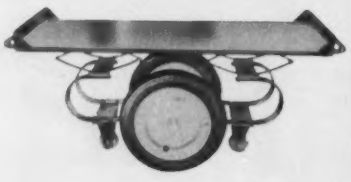

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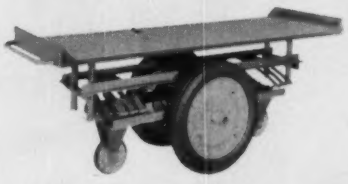

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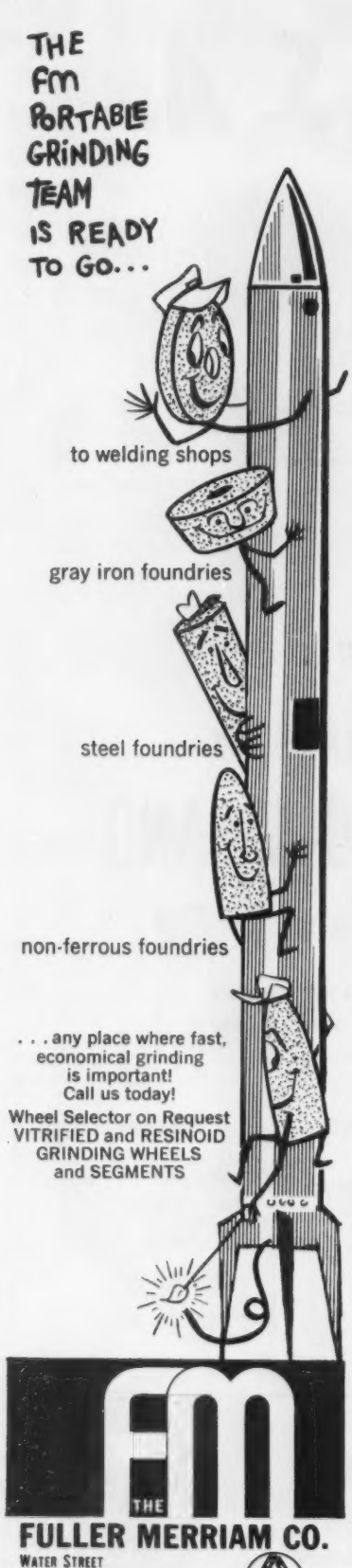

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With the EDITORS

A FOUNDRY FIRST: On April 12, Russian Air Force Major Yuri Gagarin, former foundry molder and foundry engineer, became the first human being ever to leave Earth and enter the vast new frontier of outer space.

The following day, a person signing himself Bill, and claiming to be an old friend of the late Pat Dwyer, longtime engineering editor of FOUNDRY, sent this communication by radio signal from outer space:

So the world is cheering wildly
For the lad who won the race
To be first among the humans
Who'd go flitting off in space!
It's nice to know this Rooshian,
Major Gagarin by name,
Was a decent, honest molder
In the days before his fame.
When he passed me in the starlight
On the morn of Wednesday last,
"You were thrown," I said, "in orbit?"
"Not thrown," said he, "just cast!"

Same Old Story: Once again, both government and industry are exporting sizable quantities of ferrous scrap. That readers of FOUNDRY consider this a mistake is evidenced by the newspaper clippings and comments that reach the editor's desk.

One clipping from the New York *Herald Tribune* for March 14 shows a U. S. aircraft carrier being towed 10,000 miles across the Pacific for scrapping by the Shun Fung ironworks in Hong Kong. Another from the Grand Rapids *Press*, Grand Rapids, Mich., shows a large pile of scrap awaiting export. Reports from the Pacific Coast indicate heavy scrap exports.

It seems useless to raise a question of protest for this dissipation of an important resource; important either in time of peace or during an emergency.

But many will remember the sad experience following protested exports just prior to 1941.

Two for One: What does the foundry industry need most? According to articles in the March issue (pages 94 and 99) what it needs is more basic research and more scientists engaged in that activity. But these articles apparently fail to mention another requirement.

According to an article by Robert Sommer, Saskatchewan Hospital, Weyburn, Sask., published in the "Worm Runner's Digest," an informal journal of the University of

SESSIONS TO BE REPORTED AS THEY HAPPEN

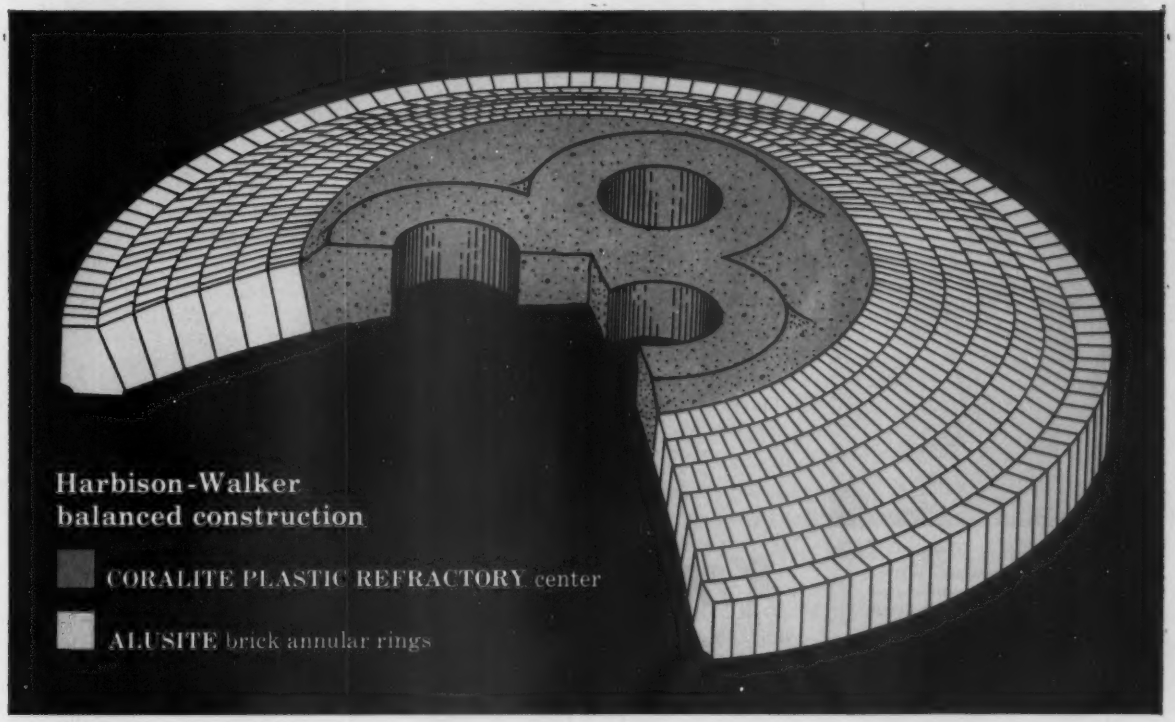
FOUNDRY will have eight staff members in San Francisco for the annual convention of the American Foundrymen's Society, May 8-12. Those in attendance will be Editor Bill Gude, Associate Editors Jack Miske and Bob Herrmann, Metallurgical Editor Edwin Bremer, Chicago Editor Erle Ross, Advertising Director Earl Thomas, Chicago Regional Director Al Johansen, and Publisher and Editorial Director Frank Steinebach.

FOUNDRY will be the only publication to have a full-time staff editor at each technical and business session. These skilled reporters, with keen knowledge on how to select the meat of any paper or discussion and present it in capsule form, will report the news as it happens.

These abstracts, which are to be published in the June (Post-Convention) and the July issues, will be the only ones available prepared on the scene by experts in the field of both foundry operations and convention reporting.

Whether you have the good fortune to attend the convention, or find the trip to the Golden Gate impossible, you will be interested in the news of events as they unfold at San Francisco. Therefore, watch for the June and July issues of FOUNDRY and the complete report of the 1961 AFS gathering.

plastic refractory centers for electric furnace roofs improve over-all economy



In electric steelmelting furnaces, balanced roof life is very important in over-all furnace economy. The center section is of particular significance since it is exposed to the most severe service. In some cases the center section is replaced at least once before the annular rings are consumed.

The use of CORALITE PLASTIC REFRACTORY in the center section with ALUSITE 70% alumina brick of standard sizes in the annular rings achieves balanced wear pattern and over-all increase in service life. Some shops report increases of 20% or more.

The superior wear resistance of CORALITE PLASTIC REFRACTORY is attributable to high refractoriness, low permeability and outstanding resistance to thermal spalling. The plastic composition provides a degree of workability that can eliminate laminations during installation.

For less severe service, a balanced roof life can be obtained with H-W MULLITE PLASTIC REFRACTORY center sections and ALAMO superduty fireclay brick or ANCHOR DASH 60% alumina brick standard sizes in the annular rings. Write for further data.

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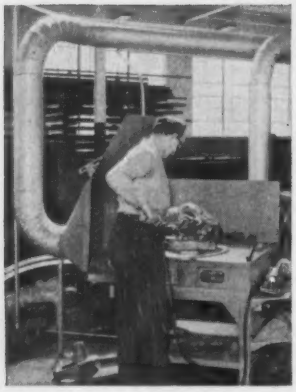
In the plant of a noted chain and forging firm, an official made this comment about a new K & B installation: "Our workmen can now work full time . . . this means added production for them and for the company as well."

Call on K & B engineers to put *AIR in Motion* and help boost your plant efficiency. The Kirk & Blum Manufacturing Company, 3108 Forrer Street, Cincinnati 9, Ohio



K & B system serving castings grinding removes dust, sand and chips as fast as they are produced. Work revolves on turntable to enable operator to work continuously.

50 YEARS OF SERVICE

KIRK & BLUM

DUST CONTROL

K & B Down Draft Dust Control System in plant of The Monarch Machine Tool Co., Sidney, Ohio

Michigan's Department of Psychology's Planaria Research Group, the big need is for more women. Mr. Sommer points out that a good secretary is worth at least two good scientists in our big research push. This is what he has to say:

It is axiomatic that a lab can produce only as fast as its secretary can type. The lab with one scientist and four secretaries is in a more favorable position than the lab with four scientists and one secretary.

In the latter case, the scientist will spend most of his day peering over the secretary's shoulder seeing whether she is showing favoritism to his three colleagues. There will be intrigues and quarrels to get letters typed, income tax forms filled out, and lead pencils requisitioned. Realistically there is no motivation for the scientist to write if there is no one to type for him.

In the lab with one scientist and four secretaries, our man is in constant turmoil to keep his assistants busy. He feels he must produce so that his harem looks busy. If they start bringing in knitting and learning bridge, his superiors will become suspicious.

The following "law" is for the scientific output of any research lab: Productivity = (Number of Secretaries × Average Typing Speed) ÷ Number of Scientists.

One interesting feature of this equation is that when the number of scientists becomes zero, productivity becomes infinite.

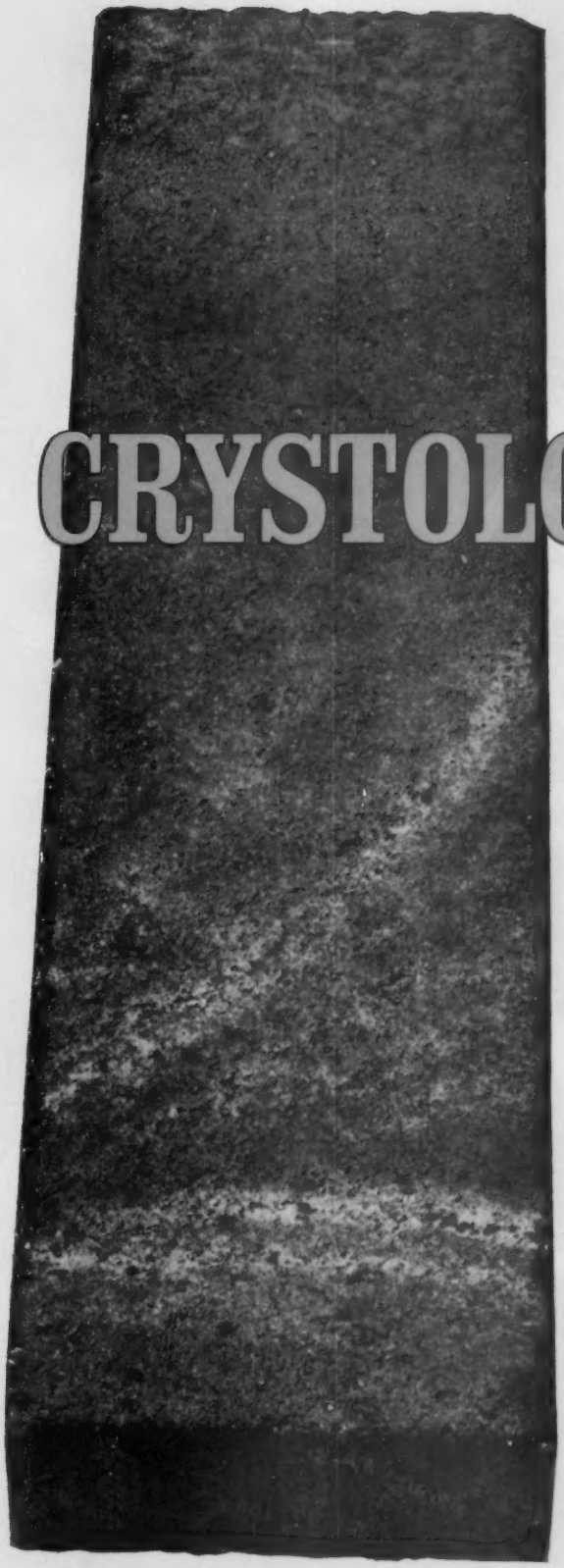
An Extra Copy: "For an extra copy of this article, until the supply is exhausted, use card on Page 39."

Many of FOUNDRY's feature editorial articles carry the above notation. Readers seem to like this extra service since many, in mailing the request card on page 39 for additional information on advertisements, reports of new equipment and supplies, or requests for new literature for foundrymen, also will ask for a copy of an article. Others will "take their pen in hand" and send us a letter asking for a copy of one or more articles.

During 1960 the editors must have done very well in selecting articles that were of interest and value to our readers. As an indication of this reader acceptance, I can report that we received 7110 requests for an extra copy of an editorial article published in the 12 issues of FOUNDRY in 1960.

Have you taken advantage of this special service developed especially for you?

F.G.S.



Now...a low-cost Nitride-Bonded Silicon Carbide!

CRYSTOLON* "63"

Now, the best-performing silicon carbide refractory is available at a realistic price! Brand-new CRYSTOLON "63" permits the use of a cost-saving nitride-bonded silicon carbide refractory for hundreds of applications.

Produced by an exclusive Norton process, CRYSTOLON "63" silicon carbide provides all the superior properties of nitride-bonded silicon carbide at a *new low cost!* It has high thermal conductivity, excellent heat shock and wear resistance, and good resistance to most corrosive liquids. In extensive tests, it not only showed excellent resistance to "wetting" by molten non-ferrous metals (aluminum, magnesium, zinc, lead and others) but also to fused salts, such as cryolite!

CRYSTOLON "63" refractories can well mean a vast improvement in many of today's metal melting and transfer operations . . . new efficiency and economy *throughout* operations such as *yours.* Get complete details now! Write NORTON COMPANY, Refractories Division, 304 New Bond St., Worcester 6, Massachusetts.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

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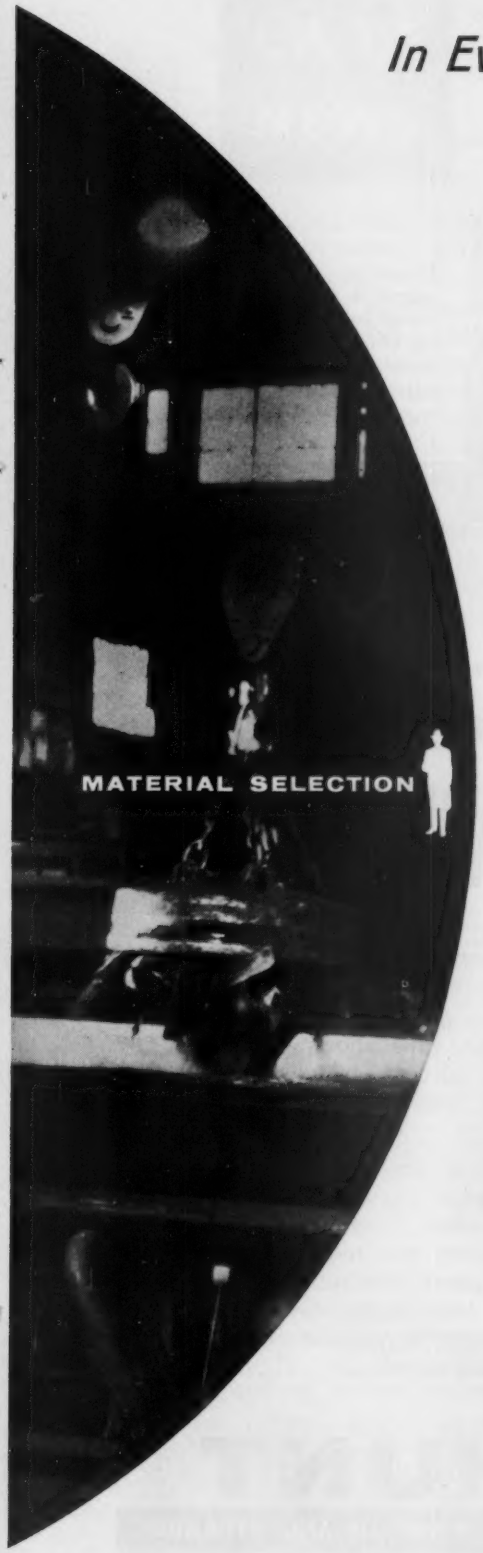
MELTING PRACTICE
POURING PRACTICE
MOLDING PRACTICE

In Every Foundry Operation



REPUBLIC ENGINEERING SERVICE CAN HELP YOU CUT COSTS THROUGH TECHNOLOGY

To help you meet increased competition in the 60's . . . to help you adapt the latest developments in casting practice to your particular business . . . to help you improve production efficiency through technology: This is the job of Republic's Complete Foundry Engineering Service.

This service goes far beyond supplying the most complete line of merchant pig iron in the industry. It goes far beyond making exact metallurgical recommendations. This is truly service in depth—bringing you information, ideas, and suggestions in every department of your foundry operation.

Whatever the size of your foundry, large or small, call in a Republic Foundry Service Engineer before you start a new job or an old one with new specifications. He will save you experimental time and money, from pattern making to finish, without obligation. And he will recommend, without prejudice, the most economical grade of pig iron for the job. Republic produces all grades of Northern and Southern Iron—Chateaugay, Northern Foundry, Malleable, Bessemer, and Basic; Southern Foundry and Basic.

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For More Information Circle 563, Page 39

Cylinder ports side and bottom tapped, ⅜, ½ or ¾ in. NPT; through ports tapped both ends and bottom, supply—1 in. NPT, exhaust and wiring conduit ports—1¼ in. NPT; meets JIC Standards.

to save space . . .

to simplify piping and wiring

New PDQ MODULAR MANIFOLD BASE

Now you can save even more space by ganging already-compact Hunt ½ in. PDQ valves on modular manifold bases!

Featuring common supply, exhaust and wiring conduit ports, PDQ modular manifold bases can be ganged end-to-end to manifold two or more valves in a single, compact assembly. Manifolding of valves simplifies supply and exhaust piping, reduces installation costs and minimizes mounting space requirements for multiple valve installations. Modular design permits adding or removing valves at a later date, to meet changing requirements. Also, bottom tapping permits additional supply, exhaust, or wiring connections at any point along the manifold assembly, if required.

Electrical connections, valve-to-base, are plug-in, to reduce downtime to a minimum. What's more, the bayonet-lock construction of Hunt's PDQ valve allows removal and installation of valve and pilot assembly in just 30 seconds, without disturbing piping or wiring.

Whether your problem is limited valve mounting space . . . complex piping . . . high installation costs . . . or you're just looking for better, lower cost, more dependable performance on new or existing equipment, ask your nearby Hunt representative to show you the advantages of modular manifold base-mounted PDQ valves.

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QUICK-AS-WINK® AIR AND HYDRAULIC

VALVES

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For more information, write for Bulletin 602. Address Hunt Valve Company, Salem, Ohio, Dept. FO-561.

3014

LATE NEWS

CASTING OUTLOOK: Although spottiness still exists, with some regions doing better than others, there's no question that the general trend of casting shipments was up in March and that the upswing seems likely to continue. The Gray Iron Founders' Society states that miscellaneous gray iron castings business was 7 per cent higher in March than in February and that the 224 foundrymen surveyed expect April to be as good as March or better. FOUNDRY editors in the field report that Pittsburgh foundries predict a 10 to 15 per cent increase in April and that New England shops are experiencing heavier volume almost across the board.

THE ROAD BACK: There also is no question that this upturn in casting sales is a reflection of better business generally. Steel production has been edging up consistently, the auto companies are moving into high gear, and construction and road building are about to move with the coming of spring. One of the best indications comes from the National Association of Purchasing Agents, whose predictions are unusually accurate. That group reports, "We may have completed the bottoming out process . . . and rounded the bend toward the up side." Other economic forecasters pretty much echo this attitude.

IRON BLOCKS: Automotive companies seem to be taking a new look at iron engine blocks. Ford Motor Co.'s new V-8 engine, dubbed the Canadian X, has a gray iron block. The new four-cylinder engine to be offered in the

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1958	50,242,746	7,725,970	821,388	7,152,726
1959				
Dec.	7,021,870	843,040	99,577	1,008,158
Total	58,979,881	9,613,059	1,156,097	9,232,037
1960				
Jan.	7,043,488	823,442	95,442	1,058,159
Feb.	6,493,558	822,476	97,688	1,015,716
Mar.	6,655,569	839,016	106,749	974,535
Apr.	5,625,717	754,486	82,767	787,186
May	5,051,121	771,300	79,170	652,585
June	4,485,444	809,297	87,485	633,797
July	3,678,127	603,062	55,974	520,361
Aug.	4,217,562	692,470	78,788	697,243
Sept.	4,148,550	732,252	76,939	641,712
Oct.	4,375,871	742,039	71,862	675,354
Nov.	3,939,970	709,187	70,282	607,471
Dec.	3,738,385	669,259	66,438	601,274
Total	59,453,362	8,968,777	939,584	9,165,395

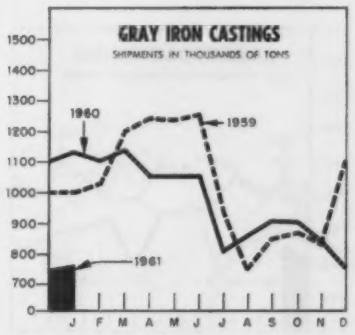
Index of Foundry Equipment Orders

Foundry Trades Only
(Net Orders Closed, New Equipment)

	1960	1961
Jan.	95.5	123.7
Feb.	128.6	81.5
Mar.	139.9	....
Apr.	97.9	....
May	159.0	....
June	164.8	....
July	80.0	....
Aug.	92.4	....
Sept.	158.1	....
Oct.	81.7	....
Nov.	106.5	....
Dec.	101.2	....

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings — Total	All Castings — For Sale	Miscellaneous Castings — Total	Miscellaneous Castings — For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[2]	Soil Pipe & Fittings Total[2]	Unfilled Orders[3]
1958	10,357,504	5,849,426	6,146,186	2,648,005	117,558	1,884,396	285,114	1,277,685	784,123	.....
1959	12,307,798	6,994,200	7,451,925	3,247,389	173,433	2,142,498	309,945	1,440,883	862,547	.....
1960										
Jan.	1,135,806	592,034	677,623	277,330	17,005	295,994	18,463	86,798	56,928	851,336
Feb.	1,107,909	571,329	679,115	279,376	16,430	284,738	17,848	76,332	49,876	855,324
Mar.	1,143,685	600,443	685,392	284,493	15,670	294,322	24,409	83,121	56,441	880,132
Apr.	1,051,700	580,931	609,577	259,335	13,980	232,895	21,737	113,886	68,606	834,495
May	1,052,798	588,770	613,745	257,180	13,126	207,094	20,414	136,455	75,090	781,596
June	1,049,638	601,597	622,236	273,148	15,010	183,049	19,810	144,773	79,770	719,564
July	803,306	450,580	478,289	202,347	10,694	120,784	16,226	120,652	67,375	784,780
Aug.	858,503	540,395	490,059	238,561	15,675	131,428	14,221	139,275	83,520	712,784
Sept.	900,497	527,227	554,788	245,887	14,616	125,688	13,460	135,327	71,234	695,325
Oct.	905,139	500,054	568,869	238,249	12,859	139,977	12,559	117,009	66,725	646,852
Nov.	835,709	454,611	538,817	230,022	11,870	123,054	12,410	102,959	58,469	568,974
Dec.	748,821	394,981	506,979	219,525	12,097	107,559	12,306	73,959	48,018	552,813
Totals	11,593,511	6,402,957	7,025,469	3,005,453	169,553[4]	2,246,582	203,863	1,335,546	782,051	.....
1961										
Jan.	760,136	406,315	504,182	222,508	11,374	123,277	11,847	69,581	50,949	599,776

*Source: U. S. Dept. of Interior Bureau of Mines. [1]Source: Bureau of the Census. [2]For sale only. [3]All cast iron pipe is shipped for sale. [4]Gray iron total includes nodular iron. [5]Monthly figures do not add up to total shown because of unreported monthly revisions.

Late News

Chevrolet H-35, scheduled for introduction next fall, also is of gray iron.

Chevrolet reportedly is working on the use of gray iron as well as nodular iron in densely rammed green sand molds. Ford for some time has been considering the use of nodular iron for thin-walled blocks under development. The aim is for wall sections as thin as 0.1 in.

Other General Motors divisions also are working on thin-walled blocks. Experimental blocks with 0.09-in. sections have been produced of regular gray iron. Outer walls of the blocks are the thinnest, additional metal for machining being provided on the cylinder walls.

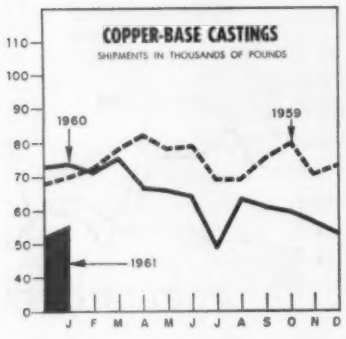
FOUNDRY MODERNIZATIONS: With the award of a $1½-million contract for an addition to foundry facilities, Ohio Steel Foundry Co., Lima, Ohio, has begun a multimillion-dollar expansion and modernization program. The new building is meant to give the company more working area for the manufacture of cast iron and steel rolls. Completion is scheduled for the end of the year.

At Franklin, Pa., Chicago Pneumatic Tool Co. will install a new foundry to replace its present foundry operation in the plant. Cost of the installation is estimated at more than $1 million. Plans call for an entirely mechanized molding unit, mechanized cupola charging, and modern sand handling and conditioning equipment.

FEF OFFICERS: New officers of the Foundry Educational Foundation, elected at the group's 14th annual College-Industry Conference, in Cleveland April 19-20, include the following: D. H. Morgan, Dow Chemical Co., president; C. F. Strom, Griffin Wheel Co., vice president; Anton Dorfmueller Jr., Federal Foundry Supply Div., Archer-Daniels-Midland Co., secretary; and W. G. Gude, FOUNDRY, treasurer. E. J. Walsh continues as executive director.

FOUNDRY CONFERENCES: Three more regional foundry conferences have been added to the fall calendar. The East Coast Regional Foundry Conference will be held Sept. 22-23 at the Statler Hotel, New York City. On

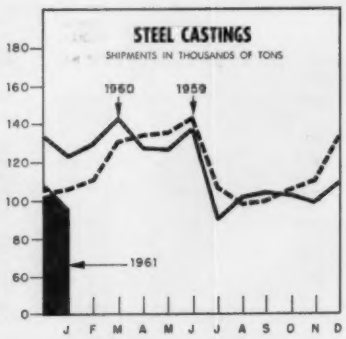
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			
	Total	Sand	Perm. Mold	Unfilled Orders[2]
1958	762,484	697,360	31,854	.....
1959	871,032	765,246	52,456	.....
1960				
Jan.	73,971	65,742	3,915	26,053
Feb.	71,797	63,103	4,146	26,970
Mar.	75,908	66,517	4,346	27,470
Apr.	66,777	58,453	4,523	27,423
May	66,299	57,848	4,463	24,582
June	64,585	56,441	3,715	21,781
July	48,399	42,778	2,910	22,367
Aug.	63,765	56,344	3,669	21,915
Sept.	61,362	54,104	3,699	21,063
Oct.	59,877	52,734	3,556	22,008
Nov.	56,358	50,043	3,132	21,261
Dec.	53,099	46,237	3,369	21,914
Total	762,107	670,344	45,443	.....
1961				
Jan.	55,878	48,928	3,286	22,792



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1958	1,121,000	856,986	149,644	801,846	606,240	136,251	319,154	250,746	13,393	.....
1959	1,412,885	1,112,668	210,984	1,043,538	814,219	194,201	369,347	298,449	16,783	.....
1960										
Jan.	122,565	94,052	19,034	93,197	70,815	17,909	29,368	23,237	1,125	314,237
Feb.	129,259	97,927	23,530	96,888	72,963	22,326	32,371	24,964	1,204	279,684
Mar.	143,708	109,688	25,702	104,742	78,755	24,266	38,966	30,933	1,436	277,982
Apr.	127,219	96,577	22,828	93,433	70,251	21,253	33,786	26,306	1,575	248,902
May	126,580	97,231	23,890	93,700	71,808	22,421	32,880	25,423	1,469	252,293
June	136,922	107,076	26,389	101,294	78,601	24,707	35,698	28,475	1,682	233,765
July	89,565	67,294	13,430	63,753	47,570	12,804	25,812	19,724	626	223,880
Aug.	101,709	77,146	14,619	73,338	55,099	13,713	28,371	22,047	906	213,611
Sept.	104,298	79,556	14,171	74,447	56,126	13,273	29,851	23,430	898	199,413
Oct.	102,664	79,622	14,586	72,544	57,879	13,544	30,120	21,743	1,042	186,311
Nov.	99,577	78,305	15,768	69,927	56,466	14,113	29,650	21,839	1,655	174,317
Dec.	108,249	87,417	24,849	78,805	64,997	22,295	29,444	22,420	2,554	162,882
Total	1,392,385	1,071,871	238,796	1,016,068	781,330	222,624	376,317	290,541	16,172	.....
1961										
Jan.	96,190	76,650	11,534	68,795	56,592	10,550	27,395	20,058	984	156,683

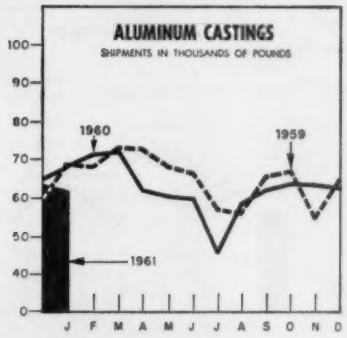
[1]Source: Bureau of the Census. [2]For sale only.

Oct. 19-20, the Michigan Regional Foundry Conference will be held at the Kellogg Center, Michigan State University campus, East Lansing, Mich. The Missouri Valley Regional Conference is set for Sept. 21-22 at Missouri School of Mines & Metallurgy, Rolla, Mo.

NCC ELECTS: E. H. King, Hill & Griffith Co., was elected president of the National Castings Council at a meeting in Cleveland April 18. Re-elected were Robert B. Parker, American Brake Shoe Co., vice president; F. Ray Fleig, Smith Facing & Supply Co., treasurer; and Frank G. Steinebach, FOUNDRY, secretary.

PERSONALS: S. Donald Sanders has been named manager, Cleveland works, National Malleable & Steel Castings Co., Cleveland . . . Thomas R. Wiltse has been appointed director of reliability, Central Foundry Div., General Motors Corp., Saginaw, Mich. Thomas E. Smith has succeeded Mr. Wiltse as plant manager of the division's Defiance, Ohio, plant, and he has been succeeded as plant manager at Danville, Ill., by Dale W. Wonus . . . I. H. Dennen has been appointed assistant general manager, Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago, and John R. Noreen has been named purchasing agent . . . John F. Torley has been elected president and general manager, Dayton Malleable Iron Co., Dayton, Ohio. He replaces Anthony Haswell, elected board chairman . . . Carl F. Joseph, formerly technical director, Central Foundry Div., has joined Miller & Co., Chicago . . . New appointments at A. C. Williams Co., Ravenna, Ohio, include Donald S. Smith and Robert C. Boehm, plant manager and chief metallurgist, Aluminum & Magnesium Div., respectively, and Bernard J. Donner, plant manager, Iron & Semi-Steel Div. . . . Robert L. Pierce has been appointed general sales manager, Chicago Hardware Foundry, North Chicago, Ill.

MISCELLANY: National Malleable & Steel Castings Co., Cleveland, will change its name to National Castings Co. on July 1, 1961 . . . Scott-Atwater Foundry Co., Minneapolis, has been licensed to make Meehanite castings . . . National Engineering Co., Chicago, has purchased Hydro-Blast Div., Guardite Co., a division of American Marietta Co., Wheeling, Ill.



PRODUCTION WORKERS

Estimated Number

	Jan. 1961	Dec. 1960	Jan. 1960
Ferrous	173,600	177,800	197,700
Nonferrous	46,100	47,300	55,400

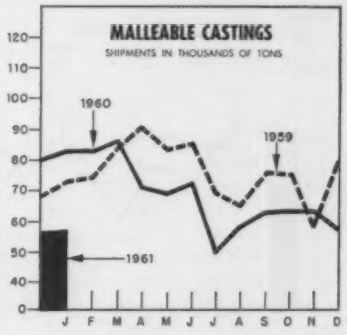
Average Weekly Earnings

Gray Iron	89.79	91.76	100.28
Malleable Iron	92.38	89.89	100.61
Steel	99.26	101.50	100.49
Nonferrous	101.89	101.38	103.16

Average Weekly Hours

Gray Iron	36.5	37.0	40.6
Malleable Iron	37.1	36.1	40.9
Steel	37.6	38.3	39.1
Nonferrous	39.8	39.6	41.1

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die	
1958	641,700	125,487	224,092	290,275	.....
1959	786,399	141,987	274,855	368,101	.....
1960					
Jan.	68,247	11,278	22,368	34,514	92,109
Feb.	71,699	11,800	23,614	36,177	83,914
Mar.	72,216	12,934	22,413	36,749	78,024
Apr.	61,797	12,339	19,950	29,400	75,243
May	60,330	10,682	21,507	28,055	75,977
June	60,068	11,280	20,953	27,722	74,699
July	45,694	8,765	15,804	20,973	76,434
Aug.	58,848	10,639	18,901	29,256	75,230
Sept.	62,116	10,514	22,031	29,527	75,144
Oct.	63,750	10,149	23,339	30,213	71,364
Nov.	63,408	9,901	23,612	29,831	73,032
Dec.	63,629	9,578	23,272	30,677	71,398
Total	751,802	129,859	257,764	363,094	.....
1961					
Jan.	61,998	10,210	21,821	29,864	65,799

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled Orders[1]
	Total	For Sale	Total	For Sale	Total	For Sale	
1958	660,650	383,839	540,600	313,597	120,050	70,242	.....
1959	916,362	557,203	729,868	449,946	186,494	107,357	.....
1960							
Jan.	83,188	46,154	63,637	35,933	19,551	10,221	100,302
Feb.	83,118	46,850	64,131	37,391	18,987	9,459	98,272
Mar.	86,243	49,907	67,448	40,422	18,795	9,485	84,679
Apr.	71,271	39,059	56,136	32,066	15,135	6,993	79,237
May	68,942	37,618	53,108	30,126	15,834	7,492	73,240
June	72,593	43,105	55,956	34,526	16,637	8,579	63,920
July	49,860	28,575	37,187	22,477	12,673	6,098	74,329
Aug.	58,785	36,765	46,522	29,077	12,263	7,688	69,853
Sept.	63,048	36,114	48,635	28,623	14,413	7,491	69,033
Oct.	63,521	35,492	47,932	27,813	15,589	7,679	56,616
Nov.	62,978	35,432	47,571	27,611	15,407	7,821	55,627
Dec.	57,154	31,500	43,319	24,729	13,835	6,771	54,657
Total	820,701	466,571	631,582	370,794	189,119	95,777	.....
1961							
Jan.	57,697	34,064	43,778	27,104	13,919	6,960	52,171

Prices of Foundry Metals and Coke

(As of April 24, 1961)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-$18.50

OVENS

Birmingham	$30.35
Buffalo	32.00
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearny, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New England, deld.	33.55
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	66.50
Boston, deld.	77.79	78.29
Buffalo	66.50	67.00
Chester, Pa.	Nom.	Nom.
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 29.75; tin bronze, No. 225, 39.25; No. 245, 33.75; high-leaded tin bronze, No. 305, 34.00; No. 1 yellow, No. 405, 29.25; manganese bronze, No. 421, 28.50.

ALUMINUM: Primary alloy No. 13, 25.90; No. 43, 26.20; No. 195, 27.60; No. 214, 29.00; No. 356, 26.80. Secondary No. 12 alloy, 21.75-22.25. Deoxidizing grades: No. 1, 23.25; No. 4, 20.00.

MAGNESIUM ALLOY: AZ91A, 40.75; AZ63A, AZ92A, AZ91C, 40.75, f.o.b. Velasco, Tex.

COPPER: Electrolytic 29.00, delivered Connecticut valley.

ZINC: High grade, 12.85, delivered. Die casting alloy No. 3, 14.25; No. 2, 14.75, delivered.

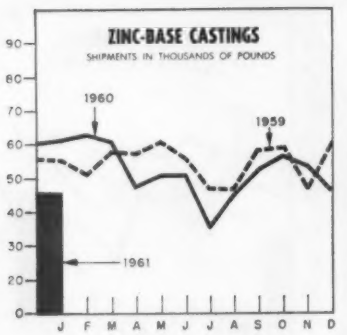
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Machinery, Cast	Structurals, Plates	Malleable	Short Steel Rails
Birmingham	$34.00–35.00	$44.00–45.00	.....	.....	$42.00–43.00	.....	$47.00–48.00
Boston*	**28.50–29.00	**39.00–40.00	.....	**40.00–42.00	.....	.....	.....
Buffalo	31.00–32.00	**38.00–39.00	.....	.....	39.00–40.00	.....	48.00–49.00
Chicago	39.00–40.00	43.00–44.00	.....	48.00–49.00	41.00–42.00	47.00–48.00	51.00–53.00
Cincinnati*	**32.00–33.00	**37.00–38.00	**29.00–30.00	**46.00–47.00	.....	.....	**46.00–47.00
Cleveland	33.00–34.00	39.00–40.00	28.00–29.00	46.00–47.00	38.00–39.00	47.00–48.00	47.00–49.00
Detroit*	**30.00–31.00	**32.00–33.00	**25.00–26.00	.....	.....	.....	.....
Los Angeles	35.00–37.00	50.00	.....	.....	52.00	.....	.....
New York*	30.00–31.00	36.00–37.00	31.00–32.00	.....	32.00–33.00	.....	.....
Philadelphia	41.00	42.00	41.00	50.00–51.00	45.00–47.00	51.00	52.00–54.00
Pittsburgh	36.00–37.00	**37.00–38.00	.....	**45.00–46.00	39.00–41.00	.....	51.00–52.00
St. Louis*	35.00	41.00	33.00	.....	.....	.....	41.00–42.00
San Francisco	42.00	46.00–47.00	28.00	45.00–46.00	44.00	.....	.....
Seattle***	44.00	42.00	39.00	.....	.....	.....	.....

*Brokers' buying prices **F.o.b. shipping point. ***Prepared, f.o.b. car.

Foundry Statistics



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[1]
1958	500,071	319,471	.....
1959	631,210	443,009	.....
1960			
Jan.	61,537	39,777	64,940
Feb.	62,925	42,089	66,945
Mar.	60,816	39,618	60,267
Apr.	47,553	31,423	56,312
May	50,844	33,551	56,654
June	50,809	34,264	51,960
July	35,117	25,186	52,392
Aug.	45,101	32,549	57,551
Sept.	52,514	34,451	57,480
Oct.	56,205	36,459	57,028
Nov.	53,574	33,758	55,306
Dec.	46,208	29,341	51,516
Totals	623,203	412,466	.....
1961			
Jan.	46,007	30,307	50,940

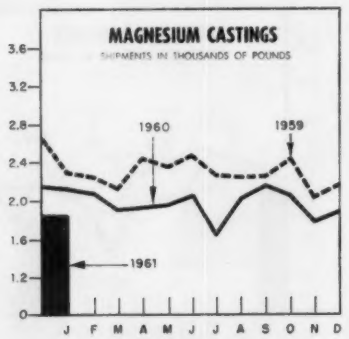
PIG IRON

PRODUCTION—Net Tons**

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1958	1,622,320	2,448,917	4,954,854
1959	1,889,445	2,810,359	3,471,683
1960			
Feb.	148,238	338,866	471,755
Mar.	126,357	333,182	462,914
Apr.	134,509	258,452	395,875
May	135,825	290,057	356,931
June	105,717	247,991	309,942
July	117,218	166,084	290,384
Aug.	78,950	171,718	211,506
Sept.	93,260	202,895	152,880
Oct.	133,525	183,639	208,758
Nov.	122,550	231,203	206,062
Dec.	130,455	153,009	202,353
Totals	1,454,836	2,902,247	3,732,027
1961			
Jan.	106,054	165,571	170,224
Feb.	98,207	144,476	214,396
2 mo.	204,261	310,047	384,620

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1958	3,314,652	169,267	231,145
1959			
Dec.	334,524	18,613	47,045
Total	3,989,129	223,868	351,355
1960			
Jan.	328,242	18,634	45,936
Feb.	322,945	19,257	42,883
Mar.	317,520	21,042	43,959
Apr.	282,178	16,796	36,971
May	292,407	15,730	19,889
June	313,340	16,828	23,720
July	241,752	11,892	21,123
Aug.	273,722	14,697	27,919
Sept.	284,809	13,548	19,962
Oct.	269,103	13,631	13,947
Nov.	254,799	12,567	17,567
Dec.	233,592	12,722	18,344
Total	3,413,409	187,644	332,200



MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1958	28,776	25,024	.....
1959	27,253	23,109	.....
1960			
Jan.	2,135	1,588	3,209
Feb.	2,075	1,679	3,278
Mar.	1,903	1,524	3,208
Apr.	1,926	1,533	3,138
May	1,953	1,514	2,948
June	2,050	1,555	3,396
July	1,638	1,234	3,541
Aug.	2,025	1,530	3,364
Sept.	2,146	1,653	3,271
Oct.	2,038	1,519	3,274
Nov.	1,776	1,269	3,433
Dec.	1,875	1,345	3,156
Total	23,540	17,943	.....
1961			
Jan.	1,862	1,436	2,847

*Source: U. S. Dept. of Interior Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For Sale only. [3]Monthly figures do not add up to totals shown because of unreported monthly revisions.

Whitehead's FINE SILICA SANDS

for Fine Finish Castings and Shell Molding

Whitehead offers the widest variety of fine washed and unwashed silica sands . . . all laboratory-tested in a Whitehead laboratory in each of the areas represented.

DIVIDING CREEK, New Jersey
Fine Washed Silica Sands

Retained on Sieve #	Grade D #71	Grade D Special #75	Grade E #96	Grade Overflow #118	Grade Superior #158
30	none	none	none	none	none
40	2.0	1.0	1.0	.2	.2
50	9.8	4.8	7.6	3.2	1.8
70	26.4	14.0	20.4	13.2	4.6
100	41.0	40.2	31.8	29.0	11.2
140	15.0	29.8	17.2	20.2	22.4
200	4.4	8.2	10.8	15.4	25.6
270	.8	1.2	5.6	8.8	14.0
Pan	.6	.8	5.6	10.0	20.2

McCONNELLSVILLE, New York
Fine Unwashed Silica Sands

Retained on Sieve #	#103	#130	#155	#180	#230	#275
30	.3	.2	none	none	none	none
40	.5	.2	.4	"	"	"
50	4.2	.4	1.4	"	.2	"
70	13.6	1.6	3.2	.4	.2	.2
100	26.1	12.4	10.2	2.5	.4	.6
140	25.7	32.8	22.0	18.0	4.0	1.2
200	20.8	37.2	30.0	35.9	21.4	6.4
270	5.5	9.8	14.2	17.4	21.4	11.2
Pan	3.3	5.4	16.8	23.8	46.4	80.4
Very Fine	none	none	1.8	2.0	6.0	

NEW ENGLAND
Marion Fine Washed Silica Sand AFSF #105

Sieve #	Retained
+6	none
12	"
20	"
30	"
40	.6
50	1.4
70	6.0
100	30.6
140	34.4
200	19.2
270	4.6
Pan	3.2

BLANEY, SOUTH CAROLINA
Washed Silica Sands

	55 B (50 — 60)	65 B (60 — 70)	80 B (70 — 95)	140 B (130 — Plus)	120 B (110— 138)
30	3.6	.4			
40	14.0	3.8	1.0		.5
50	27.7	15.6	6.6	.2	3.4
70	28.7	29.4	21.0	1.4	11.2
100	18.1	28.6	32.8	8.0	20.4
140	6.8	16.2	27.0	24.6	25.8
200	1.0	4.2	8.4	28.4	18.2
270	.1	1.4	2.4	21.8	12.1
Pan		.4	.8	15.6	8.2
AFS	51	68	82	161	121

LEADER IN FOUNDRY SANDS SINCE 1841

Whitehead Brothers COMPANY

Established 1841

NEW YORK OFFICE
324 West 23rd St., New York 11, N. Y.

NEW ENGLAND OFFICE
75 Westminster St., Providence 1, R. I.

Manufacturers of:

LYQUAGRIP
Ready-to-use core paste

DUO RESIN
Binder for baking with controlled oven temperatures

JOINT-SEAL
Plastic compound for perfect sealing

LYQUAFLOUR
For cleaner surface, better shakeout

LYQUAFACE
The liquid sand grain coating

For More Information Circle 565, Page 39

B&T DIE CASTING MACHINE CUSTOMERS ARE OUR BEST SALESMEN

Our customers are practical men. They have years and years of die casting experience with Aluminum, Magnesium and Zinc.

These are the men for whom B & T Die Casting Machines are designed and built.

These are the men who will tell you that the B & T clamp four corner toggle system assures high lock-up to the rated tonnage.

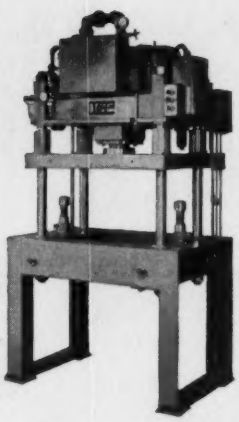
Exceptional rigidity of this four corner lock-up and support provides unusual platen stability.

Our customers will assure you that B & T Die Casting Machines lower maintenance costs, reduce scrap and improve production.

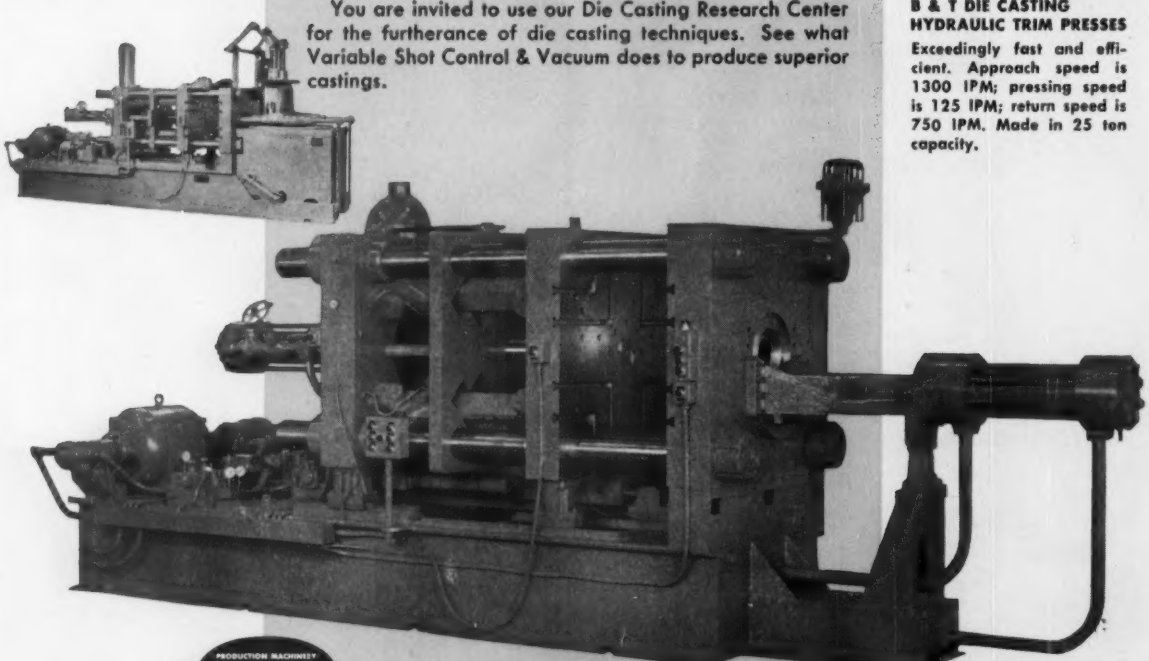
When you need a die casting machine, investigate B&T. B&T Die Casting Machines are built in High-Pressure, Cold-Chamber and Hot-Chamber, Gooseneck types. Capacities are: 125, 200, 300, 400, 500, 600, 750 and 800 tons.

DIE CASTING RESEARCH

You are invited to use our Die Casting Research Center for the furtherance of die casting techniques. See what Variable Shot Control & Vacuum does to produce superior castings.



B & T DIE CASTING HYDRAULIC TRIM PRESSES
Exceedingly fast and efficient. Approach speed is 1300 IPM; pressing speed is 125 IPM; return speed is 750 IPM. Made in 25 ton capacity.



PRODUCTION MACHINERY
GREENLEE

All of the engineering and manufacturing facilities of Greenlee Bros. & Co. are now available to B & T Machinery Company.

B&T MACHINERY COMPANY
A DIVISION OF GREENLEE BROS. & CO., ROCKFORD, ILLINOIS

201-217 West Eighth Street,
Holland, Michigan
Phone EXport 2-2341

New Jersey Zinc Opens 1961 Zinc Diecasting Competition

The "Zinc Diecasting of the Year" competition for 1961 has been opened by its sponsor, New Jersey Zinc Co., New York. Scope of this year's contest has been broadened to recognize the user of the winning diecasting as well as the diecaster.

For 1961, $500 each will be awarded to the individual in the diecaster's organization and that individual in the customer's organization who, in the opinion of their respective employers, have contributed most to the successful design and production of the casting. The awards will be presented at the annual meeting of the American Die Casting Institute in Chicago on Sept. 27.

Judging the competition will be George F. Nordenholt, former chief editor of *Product Engineering;* Burnham Finney, editor of *American Machinist & Metalworking Manufacturer;* and William G. Gude, editor of FOUNDRY.

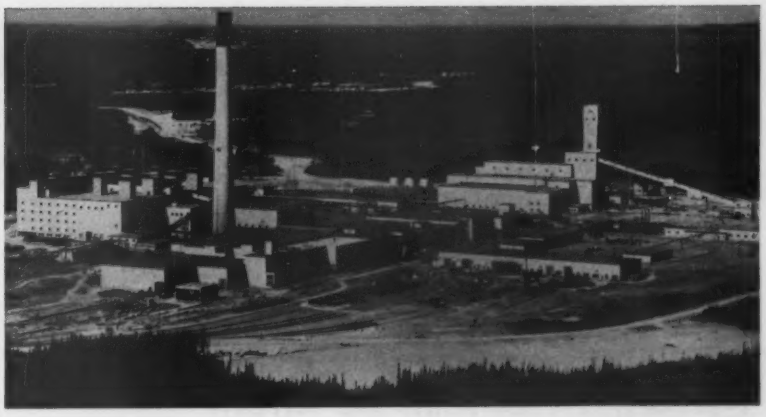
Competition closes Aug. 1, 1961, and entries must be postmarked no later than July 31, 1961. Entry blanks and additional information may be obtained by contacting C. R. Maxon, New Jersey Zinc Co., 160 Front St., New York 38, N. Y.

Ductile Iron Society To Meet At AFS Castings Congress

The Ductile Iron Society will hold a luncheon and meeting May 11 at the St. Francis Hotel, San Francisco, in conjunction with the 65th AFS Casting Congress. Guest speaker after the luncheon will be William S. Pellini, superintendent of metallurgy, Naval Research Laboratories, Washington.

Following Mr. Pellini's talk, there will be three other presentations by DIS members including "Making Small Ductile Iron Castings" by R. K. Guise, superintendent, Kuhns Bros. Co.; "The Extended Holding

(*Concluded on Page* 26)



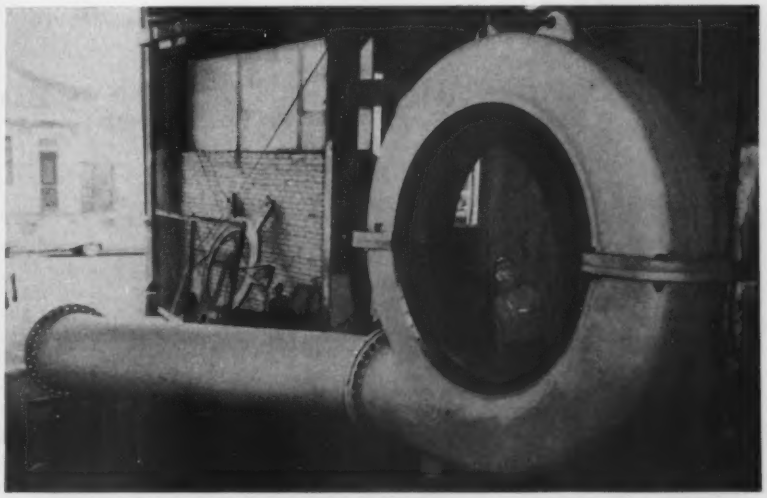
Inco Opens Integrated Nickel Plant

● THE WORLD'S first fully integrated nickel mining and processing plant was dedicated recently in Thompson, Manitoba, by International Nickel Co. of Canada Ltd.

The plant is the world's most modern nickel-producing operation and is second in size only to Inco's operation in Ontario. An aerial view shows the plant site area, which required 51 months and $185 million to develop.

The operation consists of a mine, headframe and concentrator, smelter, refinery, and service buildings. The refinery employs a new process which was developed by company research scientists and engineers and is expected to produce about 75 million lb of nickel annually. At present, the plant employs 1800, but plans call for 2300 eventually.

Adjacent to the plant is the new town of Thompson, named for Dr. John F. Thompson, retired chairman of Inco. Population is almost 4500, and the planned capacity is 8000 or more.



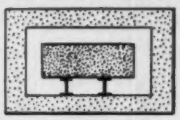
DREDGE PUMP CASTING: The two-piece dredge pump casting, shown above, was cast by Service Foundry Div., Avondale Shipyards Inc., New Orleans. It had a finished weight of approximately 35,500 lb with a wall section of 4½ in. The pump and other parts were cast of high chrome iron for Dixie Dredging Co.

use these handy FANNER selection charts to

FACTORS TO CONSIDER IN SELECTING CHAPLETS

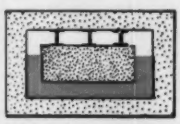
1 CALCULATE WEIGHT OF CORE

Purpose of chaplets in the drag side of mold is merely to hold core weight until metal is poured. Core weight = .06 lbs. per cu. Inch of Core



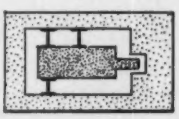
2 CALCULATE LIFT OF CORE

Purpose of chaplets in the cope side of mold is to withstand lift exerted by metal, which is 3.5 times the weight of the core for grey iron and 3.9 for steel. Core weight x 3.5 or 3.9 = Lift of Core



3 COMPENSATE FOR PRINTS AND SUPPORTS

Where prints or supports exist, load calculations should be reduced proportionately.



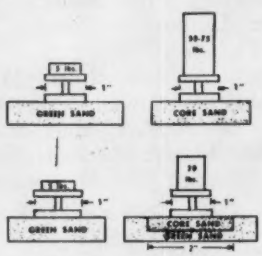
4 CALCULATE SUPPORTING CAPACITY OF SAND

Green sand in cope and drag will support approximately 5 lbs. per Sq. Inch. To determine required head area, divide load by 5 lbs.

$$\frac{\text{Load on Chaplet}}{5 \text{ lbs.}} = \text{Sq. Inches of Chaplet Head Area Required}$$

Baked Sand Cores will support 50 - 75 lbs. per Sq. Inch. To determine required head area (or bearing surface), divide load by 50 - 75 lbs.

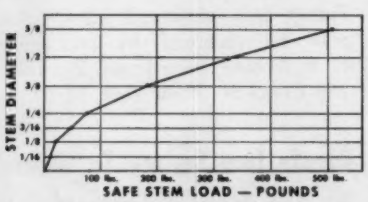
Where cores are so heavy that an excessive number of chaplets would be required, ram-up cores may be used to increase the bearing surface of green sand. For example: A chaplet with 1" head in green sand will support only 5 pounds. A 2" ram-up core (4 Sq. Inches) will provide a bearing surface to support 4 times 5 lbs., or 20 lbs.



5 CALCULATE SUPPORTING CAPACITY OF SAND

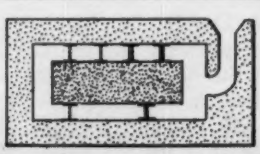
$$\frac{\text{Required Head Area (Sq. In.)}}{\text{Area of Each Chaplet Head (Sq. In.)}} = \text{Number of Chaplets Required}$$

6 USE THIS CHART TO CHECK SAFE LOAD ON STEM



7 CONSIDER EFFECT OF LOCATION AND TEMPERATURE

When chaplet location is near the gate (heavy flow of metal), or, when steel is poured at high temperatures, allow up to 50% additional stem size to compensate for effect on chaplet.

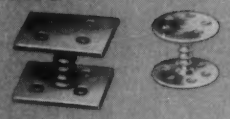
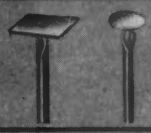
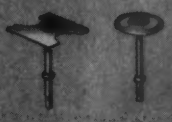


The chaplet you select for any casting can make a great difference in its quality . . . and in its overall costs. Too light or too small a chaplet may result in improper core support and a poor casting, too large or too heavy a chaplet increases chaplet costs unnecessarily. Use this graphic information to determine the correct chaplet to insure proper core support.

Write for free plastic laminated selection chart of chaplets.

insure proper selection of proper type of chaplets for your job

fine FANNER CHAPLETS are made in a wide range of types for every need

TYPE	CHARACTERISTICS	APPLICATIONS
MOTOR 	FUSE READILY STEMS CAN BE GROOVED HEADS CAN BE PERFORATED HEADS CAN BE TILTED STEMS CAN BE EXTENDED CLOSE TOLERANCES ±.002	*For Light Sections of* Motor Blocks • Heads • Housings Radiator Sections • Burner Sections • Pump Sections • Farm Equipment • Job Castings
BUTTON HEAD OR BOILER	STURDY STRUCTURE FUSE READILY STEMS CAN BE GROOVED NON-SLIP BUTTON HEAD	*For Boiler Sections*
PERFORATED	10 STANDARD SHAPES MADE TO FIT ALL CONTOURS MADE TO ALL RADII DESIGNED FOR WEDGES LOW IN COST	*For Light Sections of* Stove Castings • Motor Castings • Job Castings
DOUBLE HEAD	STURDY STRUCTURE STRONG SUPPORT TO CORE STEMS CAN BE GROOVED HEADS CAN BE CANTED RIVETED OR WELDED HEADS CLOSE TOLERANCES ±.005	*For Heavy Sections of* Machine Tool Bases • Diesel Engines • Locomotive Frames Side Frames • Pumps • Road Machinery
SINGLE HEAD 	NON-SLIP FORGED HEADS FITTED HEADS WITH ANY RADIUS SOLID SUPPORT	*For Very Heavy Cores of* Diesel Engines • Machine Bases
RADIATOR	UNIFORM BREAK-OFF NICKS DEEP NICKS FOR FIRM KNITTING LOW COST	*For Radiator Sections* Burner Sections • Pump Sections Farm Equipment • Job Castings
SHOULDER RADIATOR 	EASY TO PLACE FUSE READILY DEEP BREAK-OFF NICKS STAGGERED NICKS FOR FIRM KNITTING UNIFORM SHOULDERS	*For All Thin Sections of* Manifolds • Stove Burners Cylinder Heads

SPECIFY FANNER GROOVESTEMS TO ELIMINATE LEAKERS

Your best insurance against faulty castings is the GROOVESTEM chaplet with the Countersunk Shoulders, Featheredge Fusion Rings, and Complete Contact Radius Grooves.

When you need chaplets remember that only FANNER makes a complete line for every casting requirement. Regardless of the kind of metal you pour or the type of casting you produce, you can secure the exact chaplet you need from this one source. As a result you always save time . . . reduce costs . . . step-up production when you standardize on FANNER for all your needs.

THE **FANNER** MANUFACTURING COMPANY

Designers and Manufacturers of Fine Fanner Chaplets and Chills

BROOKSIDE PARK CLEVELAND 9, OHIO

For More Information Circle 567, Page 39

(*Concluded from Page 23*)

Times after Magnesium Treatment" by Al Bailey, superintendent, Centrifugal Casting Co.; and "The Future of Ductile Iron" by Robert S. Thompson, president, H. P. Deuscher Co., and president of the society.

The program has been planned so that members may attend AFS ductile sessions before and after the meeting. Society directors will be elected just prior to the luncheon.

Canadian Foundrymen Meet At Winnipeg Conference

About 150 foundrymen participated in a foundry conference held March 7-8 at Winnipeg, Man., Canada. The meeting, sponsored by the Foundry Supply Co., Minneapolis, was devoted to discussion of practical foundry subjects.

Sand control and testing was the main topic of Tom Barlow, International Minerals & Chemical Corp. R. A. Green of the same company talked on "Moisture and its Effect on Sand and Castings." David E. Neustadt, National Metal Abrasive Co., discussed "Airless Blast Cleaning."

"Alloying of Iron and Steel" was the topic of Spencer Phillips, Ohio Ferro-Alloys Corp. Arthur Lund, Core Lube Inc., spoke on coremaking problems and their solution, and R. E. Allen, Canadian Refractories Ltd., discussed refractories in cupolas and electric furnaces.

Misco Precision Casting Co. Establishes Scholarship Fund

A college scholarship fund has been established by Misco Precision Casting Co., Muskegon, Mich., to provide an incentive to students to qualify themselves to be educated in engineering fields which may be of future value in employment with Misco.

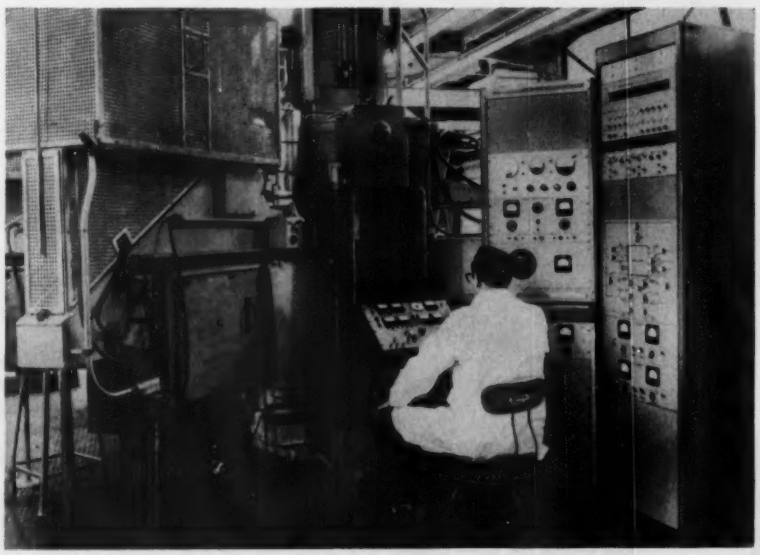
Beginning in 1962, seniors of high schools in Whitehall or Montague, Mich., and all sons, daughters, and legally appointed wards of Misco employees can become eligible for the $500 scholarship by establishing their financial need. The scholarship will be awarded for study at accredited schools in Michigan and may be renewed yearly by reapplication, contingent on achievement of satisfactory grades each preceding year.

British Foundrymen Will Hold Annual Conference May 15-18

Fifty-eighth annual conference of the Institute of British Foundrymen will be held on May 15-18 at Cheltenham, England. Eighteen papers are to be presented on subjects including gray iron, brass, plant maintenance, melting furnaces, heat treatment of gray iron, impact testing of gray iron, and die-casting.

In addition, one day of the conference has been set aside for tours of nearby foundries and manufacturing plants. The ladies program includes style shows, luncheons, and sightseeing tours.

MANAGEMENT TRAINING: A series of 16 weekly management training classes has been provided for its members by Conestoga Foundrymen's Association. Planning the program are, left to right, Harold Myers and Timothy C. Leary, seated, and Robert Muhleman, association chairman, and James Murphy Jr. and Prof. Vernon L. Van Horn, Pennsylvania State University Extension, standing. Classes began earlier this year and are being taught by faculty members from the Pennsylvania State University Extension



ELECTRON BEAM FURNACE: Photo shows a technician operating a 300-kw electron beam furnace purchased by Union Carbide Corp. from Stauffer Chemical Corp., Metals Div., Richmond, Calif. Unit operates at over 6000°F and in a vacuum as low as 10^{-4}mm Hg. It will melt up to 20,000 lb of refractory metals per month. Union Carbide Metals Co. and Haynes Stellite Co., divisions of Union Carbide Corp., will use the furnace for development work

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BEAR BRAND Abrasives

Guard has been removed for photographic purposes only

For More Information Circle 568, Page 39

FOR EXAMPLE, SUPPOSE YOU'RE LOOKING FOR A BETTER METHOD OF SEPARATING MATERIALS ...and moving them to or from storage. Here's where your Carrier Vibrating Equipment Specialist enters the picture.

Carrier specializes in providing solutions to such problems, so your Carrier Specialist has the know-how to develop a cost-saving answer. It may be that in addition to providing equipment that will assure effective materials moving, he can combine other processing steps into one capacity-increasing operation.

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Why not have your Carrier Specialist study your operations with a view to reducing handling costs while increasing over-all efficiency. Remember, Carrier does more than just build equipment...we provide the specialized service that solves problems of moving and processing materials efficiently.

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VIBRATING EQUIPMENT

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SPACE AGE FURNACE: Fluidized bed furnace for heat treating metal parts maintains uniform temperature and permits rapid changes in heat. It was developed by Boeing Airplane Co., Seattle, and will be produced and sold by Turnkey Engineering Co., South Gate, Calif., a subsidiary of Electric Furnace Co., Salem, Ohio

SFSA Issues Revision of Casting Specifications Summary

The Steel Founders' Society of America has announced publication of a revised edition of "Summary of Steel Castings Specifications."

Prepared by the Specifications Committee of SFSA, the revised summary includes a major change in Federal Specification QQ-S-681. Several new classes have been added to specification A-296, and the property values have been changed on some classes in specifications A-297 and A-351. Two new methods of testing applicable to steel castings have been adopted and are included in the revised summary.

Individual copies of the eight-page summary may be obtained free of charge from SFSA members or by writing to the society at 606 Terminal Tower, Cleveland 13, Ohio. It may be purchased in quantity from the society at 10 cents per copy.

Seeks To Win Aluminum from Clay

● PRODUCTION of aluminum from common clay or shale has become a probability for the future, according to Olin Mathieson Chemical Corp., New York.

A new process for purification of aluminum sulfate has been developed through the pilot plant stage in Olin's metallurgical laboratories. This material reportedly can be processed into alumina, the basic raw material for the manufacture of aluminum.

Present source of alumina is bauxite, 80 per cent of which is imported. Consequently, bauxite is processed at deepwater ports, and the alumina produced then is shipped inland to reduction plants situated near sources of cheap electric power. When the new process is fully developed, however, the whole operation can be located on one site where coal for electric power is cheap, since shales associated with most coal could be an excellent source of alumina.

The process for extracting usable alumina from common clay and shale consists of three steps:

1. Low alumina content clays or shales are leached with sulfuric acid to put aluminum into solution; some iron is dissolved also. 2. The iron and the aluminum sulfate are separated by crystallization from the solution. 3. The resulting aluminum sulfate crystals are processed into alumina, and the sulfuric acid is recovered for reuse.

The leaching step has been developed already, but previous crystal-

(*Concluded on Page* 32)

NEW STORE: These crates in the shipping room of the DoAll Co., Des Plaines, Ill., are destined for the company's new sales-service store just opened in Dusseldorf, Germany. Inspecting them are, left to right, L. J. Skoner, vice chairman; P. J. Weber, executive vice president; Paul Janensch, sales personnel head

TRULY SUPERIOR BONDING CLAY

Our 37 years of experience in processing prime Southern Ohio clays assures you unequalled uniformity and quality, which enables you to produce molds with unusual green, dry, and hot strength. Superb Air Floated Clay and Fire Clay also available. Contact us directly . . . or through your foundry supply dealer.

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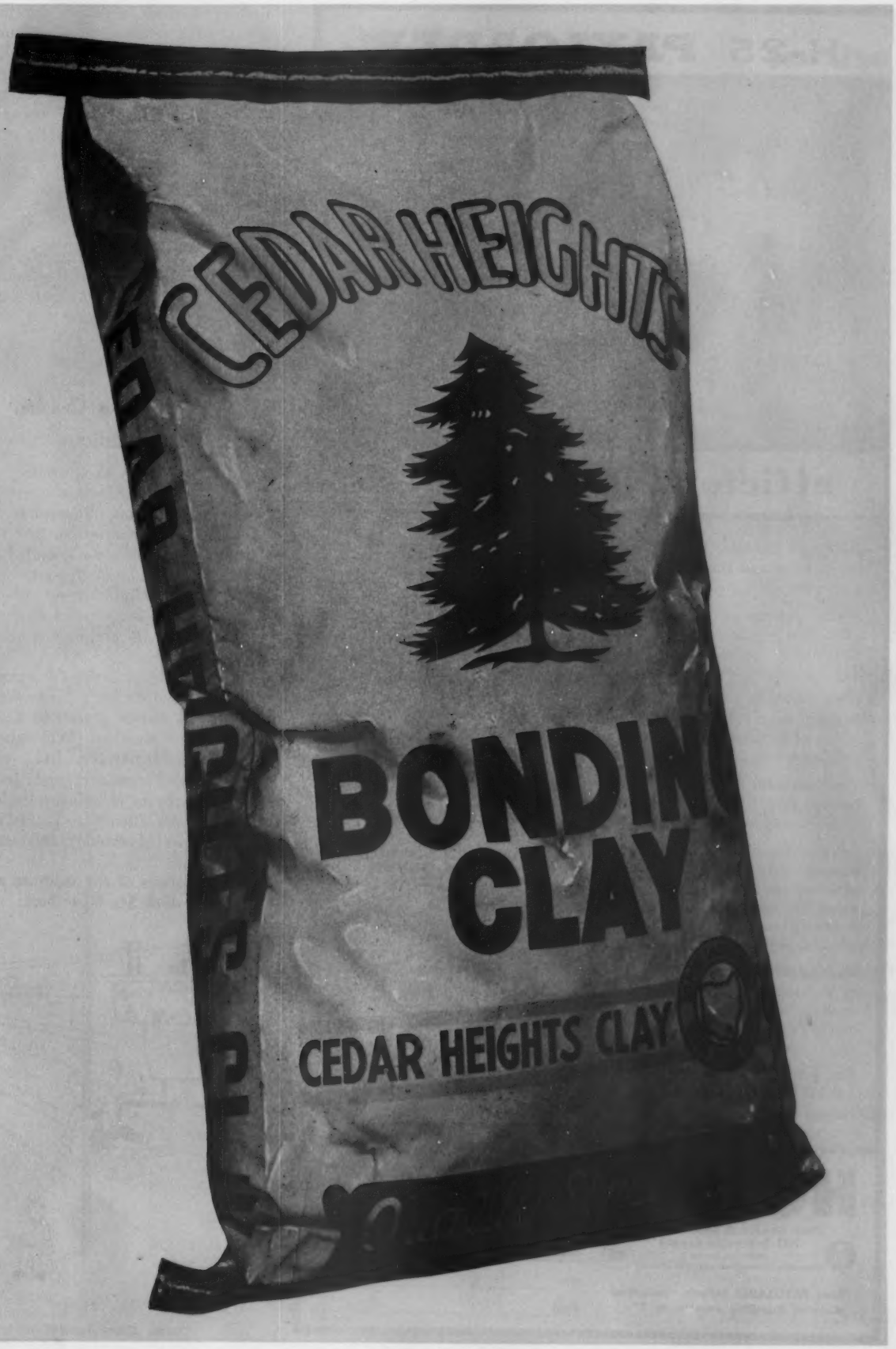

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H-25 PAYLOADER®

efficient sand handler

Buck Iron Co. Inc., in Buck, Pa., has a fine reputation for malleable iron, bronze and aluminum castings. This is a job foundry specializing in marine hardware.

Several years ago this firm bought an HA PAYLOADER tractor-shovel of 2,000-lb. operating capacity to handle the materials for both its iron and bronze castings. Late in 1960, another PAYLOADER was added. This time they selected the larger capacity (2,500-lbs.) Model H-25.

Sand handling is the principal job of these two units. This entails moving about 150-tons twice during the operation, working within 150-ft. of the shaker. They windrow the sand after shakeout, haul it to the shaker and, later, redistribute it from stockpile to 26 molding stations.

Vice President L. A. Dunn reported being *"very well pleased"* with the performance and production of the two loaders. He added that he *"particularly liked the ruggedness and dependability of the H-25."*

Satisfactory performance on the part of the H-25 is no accident. Its superior basic design includes mechanical features that provide speed, mobility and operating ease . . . such as, its short 6-ft. turning radius aided by power steering, its *complete* power-shift transmission with matching torque converter, power-transfer differential and fast, powerful hydraulic bucket control.

Dependable operation. The H-25 has "extra protection" built into it to withstand rugged duty . . . a closed, pressure-controlled hydraulic system *plus* special filters and seals throughout the machine to protect mechanical and electrical parts from damage due to dust, moisture and corrosion.

You will find that an H-25 in your operation will pay for itself very quickly through savings in increased output and lower costs. A nearby Hough Distributor is ready to demonstrate.

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lization methods necessary for the second step resulted in aluminum sulfate crystals too small and mushy to allow sufficient separation of the iron. The new development involves formation of large crystals which can be separated easily and with high purity. The accompanying view shows a technician checking the pilot crystallizer which accomplishes this essential step in the process.

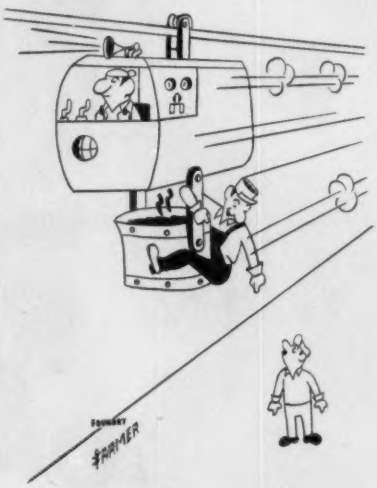
Work now is proceeding to find the best method for decomposing aluminum sulfate to alumina and for recovering the sulfuric acid economically.

New Industrial Gas Cleaning Institute Elects Officers

The Industrial Gas Cleaning Institute held its first annual meeting recently and elected officers and directors. The organization, first incorporated in 1960, was founded to conduct studies and research on methods for improving air pollution control. It is composed of manufacturers of air pollution control equipment.

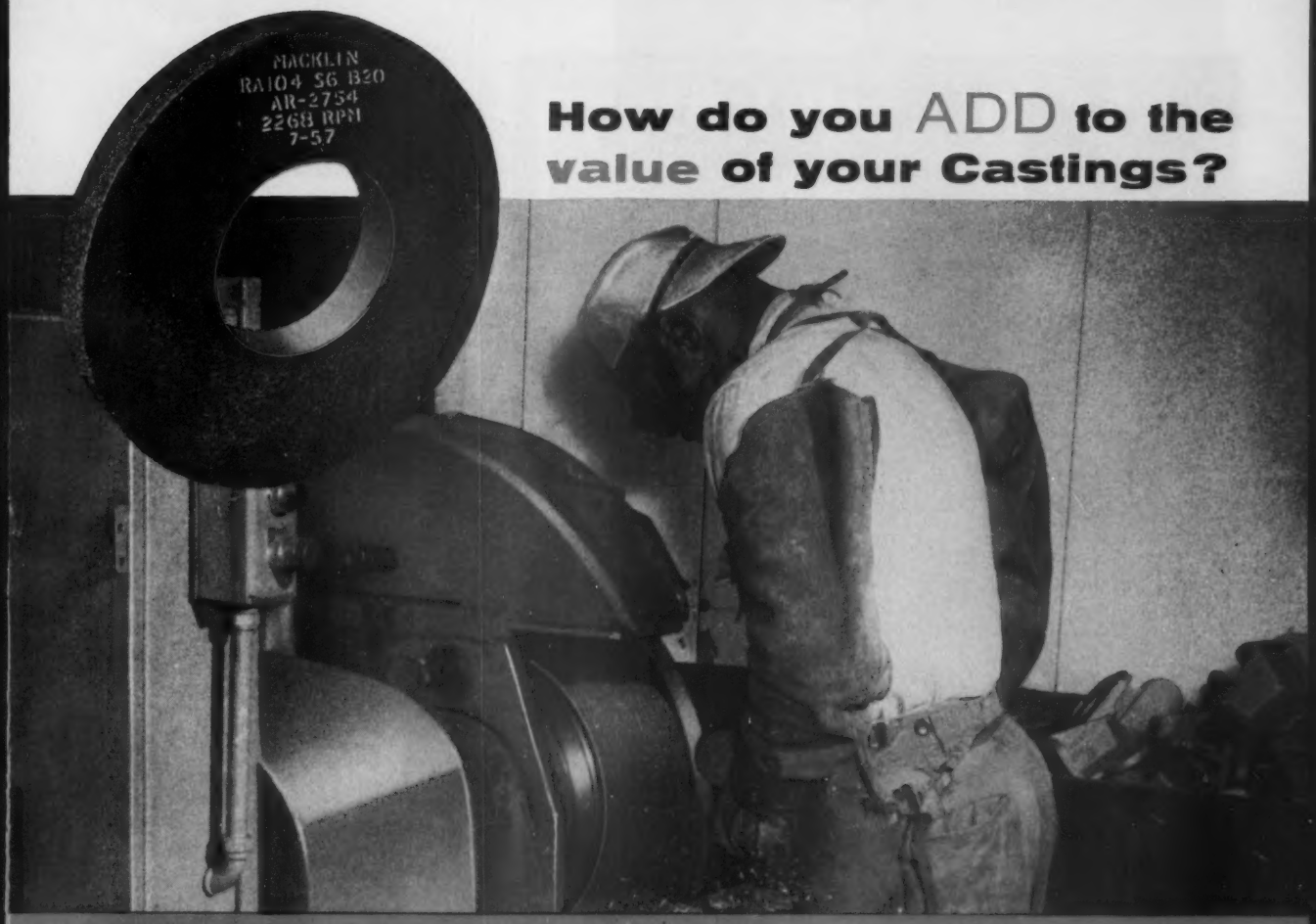
John T. Doyle, vice president, Aerotec Industries, Greenwich, Conn., was elected president; L. L. Andres, vice president, Wheelabrator Corp., Mishawaka, Ind., was elected vice president; and John Liskow, manager of industrial sales, American Air Filter Co., Louisville, Ky., was elected secretary and treasurer.

Headquarters of the institute are at 23 W. 45th St., New York.



"Look, Disneyland!"

How do you ADD to the value of your Castings?



There's a MACKLIN *"wheel of Profit"* ..... that will do the Job!

WHETHER YOU SNAG CAST IRON, MALLEABLE IRON, OR NON-FERROUS CASTINGS, you snag more metal per dollar, keep your finished casting costs down, when you put Macklin snagging wheels to work in your cleaning room. Yes . . . grinding wheels do add value to your castings, and MACKLIN wheels add *more* at *less cost* to you.

On floor stands, portables, and swing frames, Macklin foundry wheels give cool, fast cutting. Long wheel life. They require less dressing, and hold corners better. And, Macklin's modern production techniques give users the closest possible wheel duplication, order after order.

LEADING FOUNDRIES REPORT...

Alloy nickel *"wheel cuts fast, finish is good."*

Steel Castings *"time per casting cut almost 4 minutes."*

Pearlitic iron *"cutting action very good. Long life."*

Cast iron *"wheel outlasted competitive wheel by 12 hours."*

YOUR MACKLIN DISTRIBUTOR WILL GLADLY ARRANGE AN ON-THE-JOB TEST, or write direct.

GRINDING WHEELS

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For More Information Circle 572, Page 39

BINDERS CUT OUT FOR EVERY CORE PROCESS

1. BINDERS FOR EVERY CORE PROCESS: Featuring CHEM-REZ A-200, the chemically-reactive binder that "bakes" at room temperature; CHEM-REZ "100", with hot box curing, makes intricate cores at high production rates; LIN-O-SET, ADM's air-setting binder; ADCOSIL, for CO_2 gas-cured cores; ADMIREZ foundry resin for shell molds and cores; LINOIL and INDUCTOL, industry's most reliable oils for quality baked-sand cores.

Archer-Daniels-Midland company
FEDERAL FOUNDRY SUPPLY DIVISION
2191 West 110th Street, Cleveland 2, Ohio

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Calendar of MEETINGS

May 1-3—American Zinc Institute, annual meeting, Drake Hotel, Chicago.

May 8-12—American Foundrymen's Society, Castings Congress, Sheraton Palace Hotel, San Francisco.

May 9-11—Material Handling Institute, Eastern States Show, Trade and Convention Center, Philadelphia.

May 15-17—British Investment Casters' Technical Association, annual conference, London, England.

May 15-18—Institute of British Foundrymen, annual conference, Cheltenham, England.

May 17-19—Society for Nondestructive Testing, Eastern Regional Convention, Sheraton-Mount Royal Hotel, Montreal, Quebec.

May 21-24—Industrial Heating Equipment Association, annual spring meeting, Homestead, Hot Springs, Va.

May 22-25—American Society of Mechanical Engineers, Design Engineering Show, Cobo Hall, Detroit.

June 5-7—American Society for Quality Control, annual convention and exhibit, Sheraton Hotel, Philadelphia.

June 8-9—Malleable Founders' Society, annual meeting, Broadmoor, Colorado Springs, Colo.

June 13-14—Connecticut Safety Society, annual meeting, Statler-Hilton Hotel, Hartford, Conn.

June 18-20—Alloy Casting Institute, annual meeting, Homestead, Hot Springs, Va.

June 18-24—28th International Foundry Congress, Vienna, Austria.

June 20-21—Investment Casting Institute, technical course, Case Institute of Technology, Cleveland.

June 22-24—Penn State Regional Foundry Conference, Pennsylvania State University, University Park, Pa.

June 25-30—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

Aug. 28-Sept. 1—International Heat Transfer Conference, University of Colorado, Boulder, Colo.

Sept. 11-13—European Investment Casting Congress, Italy.

Sept. 18-20—Non-Ferrous Founders' Society, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 21—Cast Bronze Bearing Institute, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 24-26—Steel Founders' Society of America, fall meeting, Homestead, Hot Springs, Va.

Sept. 27-28—American Die Casting Institute, annual meeting, Edgewater Beach Hotel, Chicago.

Oct. 5-6—Ohio Regional Foundry Conference, Netherland Plaza Hotel, Cincinnati.

Oct. 7-10—Conveyor Equipment Manufacturers Association, annual meeting, Ponte Vedra Inn, Ponte Vedra Beach, Fla.

Oct. 18-20—Gray Iron Founders' Society, annual meeting, Royal York Hotel, Toronto, Ont.

Oct. 19-21—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Oct. 23-27—American Society for Metals, National Metal Congress & Exposition, Cobo Hall, Detroit.

Nov. 13-15—Steel Founders' Society of America, Technical & Operating Conference, Hotel Pick-Carter, Cleveland.

Nov. 15-17—National Foundry Association, annual meeting, Savoy-Hilton Hotel, New York.

Nov 17-18—East Coast Regional Foundry Conference, New York.

Dec. 6-8—American Institute of Mining, Metallurgical, & Petroleum Engineers, Electric Furnace Conference, Penn-Sheraton Hotel, Pittsburgh.

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From fine grained satin finishing to fast, heavy metal removal . . . from deburring to chipping . . . from wet or dry sanding to sawing . . . there's a Master Power-ful air tool to do the job. PREMIUM POWER* makes the difference. Not only more power per cubic foot of air consumed, but Master Power tools sustain their original power longer. Write or phone today for the complete story and a free air-tool study of your plant needs.

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Advertising content in FOUNDRY is classified by subject and listed by page number for your convenience when studying specific foundry applications. For further information on subjects advertised, refer to advertisement on the page indicated and circle Item Number on Reader Service Card—Page 39

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FOUNDRY

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FIRST CLASS
Permit No. 36
CLEVELAND, OHIO

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in the United States
—POSTAGE WILL BE PAID BY—

FOUNDRY
Penton Building
Cleveland 13, Ohio

Reader's Service Dept.

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Penton Building
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Blast cleaning time cut in half breakage eliminated with spinner hanger cabinet

Castings which could not withstand tumbling action are blast cleaned quickly and safely in this versatile Wheelabrator Spinner Hanger Cabinet at Greenlee Bros. & Co.

A demonstration of WHEELABRATOR'S

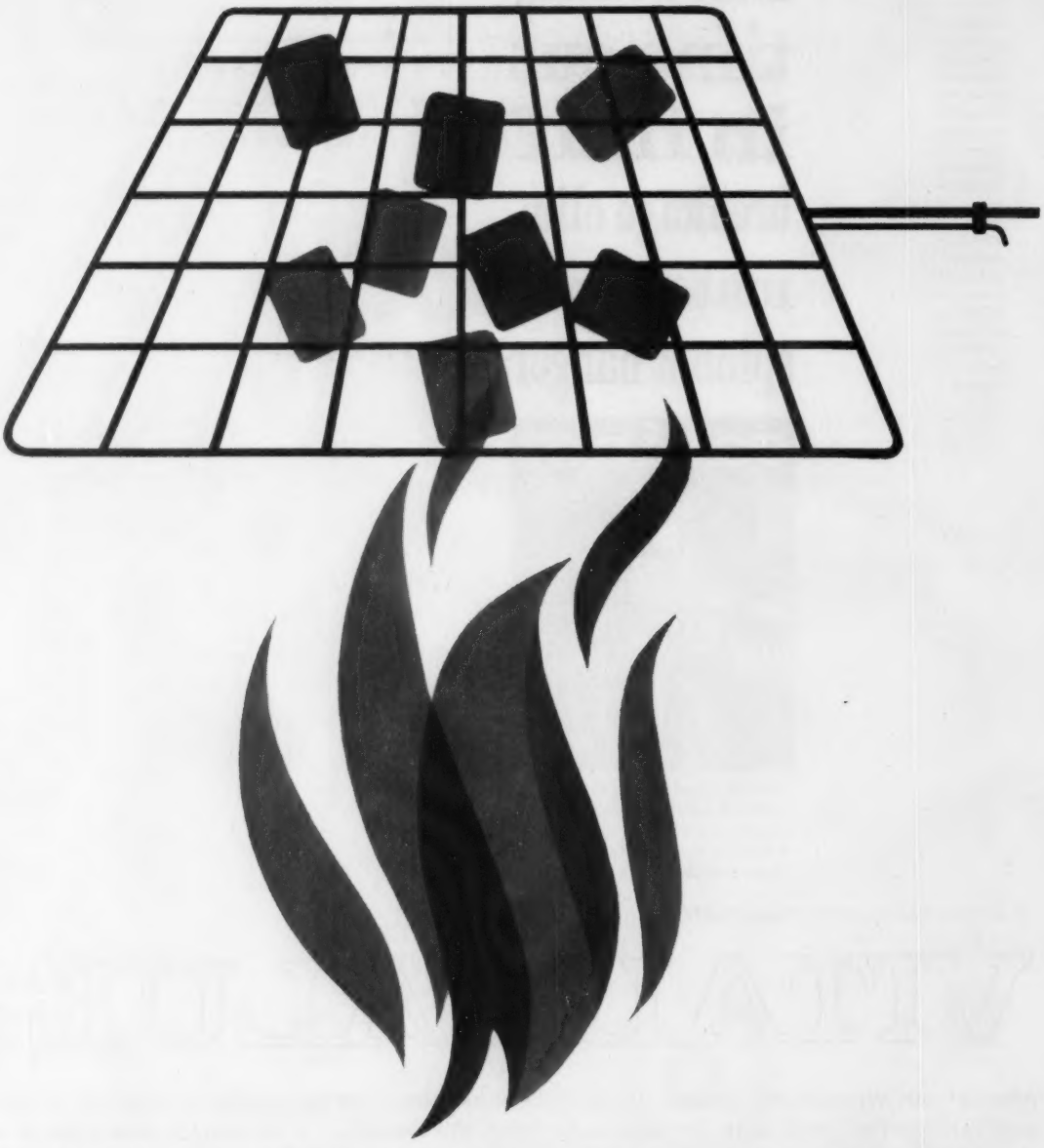
VITAL VALUES

Although this Wheelabrator Spinner Hanger Cabinet has eliminated the problem of breakage of high tensile gray iron castings which were not suitable for batch mill cleaning, the big savings have come in reduced cleaning time. Blast times have been cut 50% by the efficient exposure of all surfaces to the blast of the two Wheelabrator units. With this versatile Wheelabrator, this foundry now cleans in 6 hours tonnage equal to their former 12-hour output. Abrasive and parts costs also are proportionately lower. Savings like these are vital to operating efficiency and profits—and are the heart of the values you get from Wheelabrator equipment and services. Write for complete information.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR® AIRLESS BLAST EQUIPMENT

WHEELABRATOR CORPORATION, 505 S. Byrkit St., Mishawaka, Indiana. In Canada, WHEELABRATOR CORPORATION OF CANADA, LTD. 1901 Birchmount Rd. P.O. Box 490, Scarborough, Ontario
A subsidiary of Bell Intercontinental Corp.

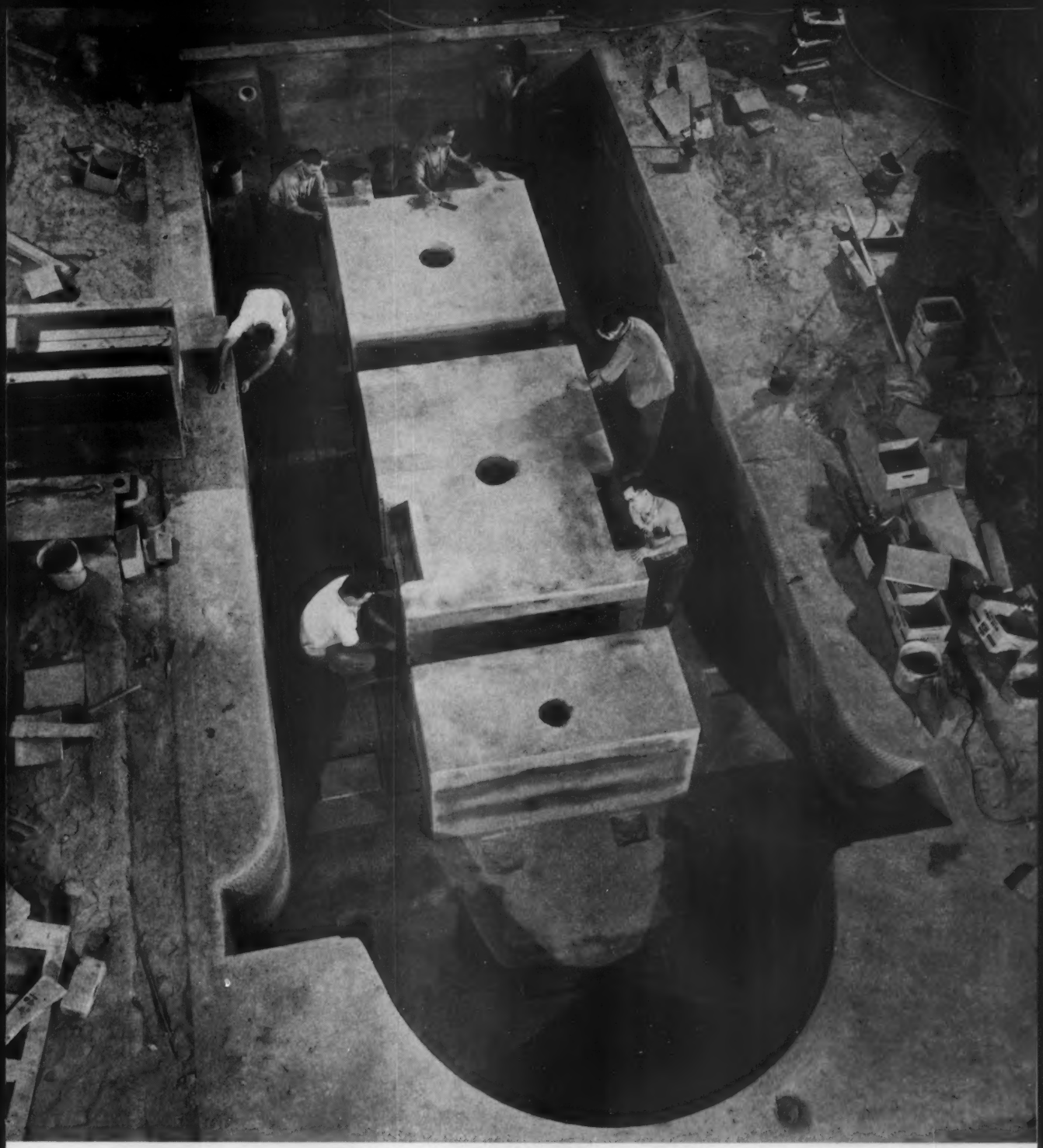


toasted nickel briquettes for low H_2 diet

Sherritt's recipe for making low-hydrogen nickel is as effective as it is simple: take pure nickel powder, press into uniform briquettes, and heat for a quarter of an hour at 1650°F. The result: pure nickel in its handiest form, with scarcely a trace of hydrogen. High-purity Sherritt nickel is also available in three standard grades of powder, special grades, and coated powders.

FOOTE MINERAL COMPANY *is the exclusive sales agent for Sherritt nickel and cobalt in the United States and Canada. For complete illustrated brochure with prices and delivery information, contact the Foote Mineral Company, 473S Eighteen West Chelten Building, Philadelphia 44, Pa.*

SHERRITT GORDON MINES LIMITED



The cores and this mold for a 426,000 lb steel casting were made by Mesta Machine Company with Venango sand — one of 35 grades of foundry sand available from Pennsylvania Glass Sand Corporation. Next time you need sand or silica flour for any casting requirement, contact PGS.

PENNSYLVANIA GLASS SAND CORPORATION

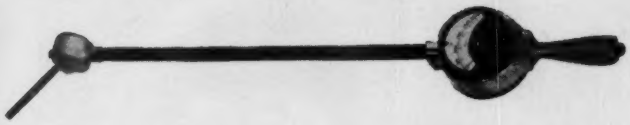
INDUSTRIAL SILICA DIVISION PIONEER SILICA PRODUCTS CO.

Sales offices in New York, Pittsburgh, St. Louis and Dallas · **Plants** in Newport, N. J. · Mapleton, Pa. · McVeytown, Pa. · Utica, Pa. · Berkeley Springs, W. Va. · Dundee, Ohio · Geauga Lake, Ohio · Phalanx, Ohio · Klondike, Mo. · Pacific, Mo. · Mill Creek, Okla. · Brady, Texas.

For More Information Circle 578, Page 39

Rejects CAN be reduced with the Alnor Pyro-Lance®

Test temperature below surface of metal in melting pot and pouring temperature in crucible.



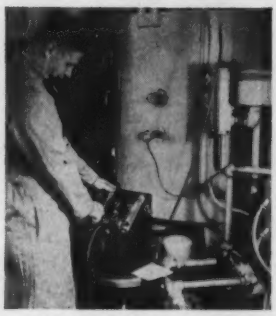
for testing of pouring temperatures of brass, bronze, tin, aluminum, babbitt, and other non-ferrous metals.

The Pyro-Lance with enclosed protected thermocouple will give submerged temperatures of molten metal in a few seconds. Exact pouring temperature assures even flow of metal in mould, resulting in a good casting. A rugged instrument with a working temperature range up to 2300° F. Price $97.00

Pyrocon®

A surface temperature reading instrument. Will give almost instant temperature of die moulds, or any stationary surface. Thermocouples available for temperature readings of moving sheets, or rolls. Seven standard temperature ranges 0-300° F. to 0-1600° F. Price $125.00

Dew-Pointer®



Gives a fast, accurate determination of the dew point of gas atmospheres—for determining the carbon potential in heat treating furnaces during operation. Portable. Price $410.00

Velometer®

Air flow of exhaust systems can be read instantly in feet per minute. Range from 20 f.p.m. to 3000 f.p.m. and 6000 f.p.m. Price $194.00

Write for detailed specifications on these products

Alnor INSTRUMENTS

ALNOR INSTRUMENT CO.

Division of **Illinois Testing Laboratories, Inc.**

Room 511 • 420 North La Salle Street • Chicago 10, Illinois

Why let long-established habit dictate your selection of grinding wheels?

Sure, the grinding wheels you've always used may be doing the job, *BUT . . . is that job good enough* in today's cost squeeze? Let Simonds help *you* update *your* grinding practices. Complete line, available through Simonds distributors, includes wheels of all abrasives and bonds, all sizes and shapes . . . all industrially-renowned products, in efficiency-proved specifications . . . and backed by our 60 year reputation as a top-rank producer of abrasive grain and grinding wheels. Send for complete descriptive catalog.

SIMONDS ABRASIVE CO.
PHILADELPHIA 37, PENNA.
DIVISION OF SIMONDS SAW AND STEEL CO.

your "buy-words" for better grinding
CALL YOUR SIMONDS DISTRIBUTOR
helping YOUR business is HIS business

WEST COAST PLANT: EL MONTE, CALIF. — BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO
SHREVEPORT — IN CANADA: GRINDING WHEELS DIVISION, SIMONDS CANADA SAW CO., LTD., BROCKVILLE, ONTARIO • ABRASIVE PLANT, ARVIDA, QUEBEC

For More Information Circle 580, Page 39

Another *plus* of Lightweight B&W Insulating Firebrick

LOWER REHEAT SHRINKAGE means MORE STABLE

REHEAT SHRINKAGE
B&W · IFB · 0.0%
Competitive IFB · .69%
NOTE: The above chart, based on available published figures, shows the appreciable difference in linear reheat shrinkage between B&W IFB and the average of seven other insulating firebrick. This example, specifically covering 2300F use limit insulating firebrick, is representative of B&W IFB's low reheat shrinkage at all recommended temperature levels.

All insulating firebrick are not the same. Published figures show wide variations in *all* of the important properties among the leading brands of brick.

Take reheat shrinkage. Tnis important property affects furnace stability, refractory life and fuel costs. Reheat shrinkage ranges from a B&W Insulating Firebrick low of 0.0% to a high of 1.5% for competitive insulating firebrick. The closest any other IFB comes to matching B&W IFB is 0.3%.

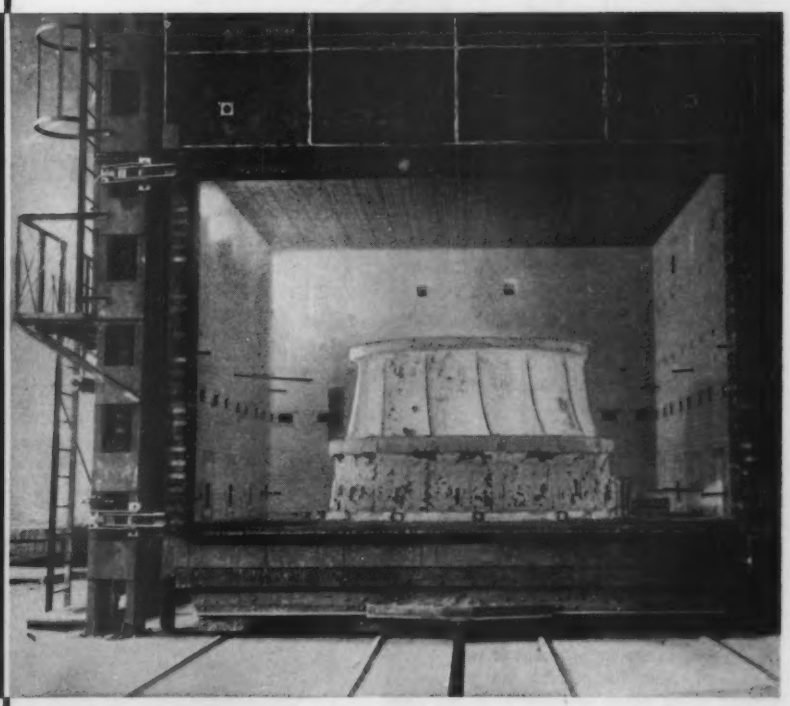
You are paying for insulating firebrick . . . make sure you get *all* the benefits. B&W—the originator of IFB—manufactures a full line of IFB with an experience-proved balance of light weight, high insulating value, high strength and long life.

For complete information on B&W Insulating Firebrick, write for Catalog R-38 to The Babcock & Wilcox Company, Refractories Division, 161 East 42nd Street, New York 17, New York.

ONE OF A SERIES

FURNACE CONSTRUCTIONS

the payoff



Stability means low maintenance —

This large car bottom annealing furnace has given years of low maintenance service because of the stability of B&W Insulating Firebrick. Furthermore, the high insulating properties of B&W IFB have resulted in lower fuel costs and close temperature control. This is just one of many proofs in our files that "there is an important difference in insulating firebrick."

R-660

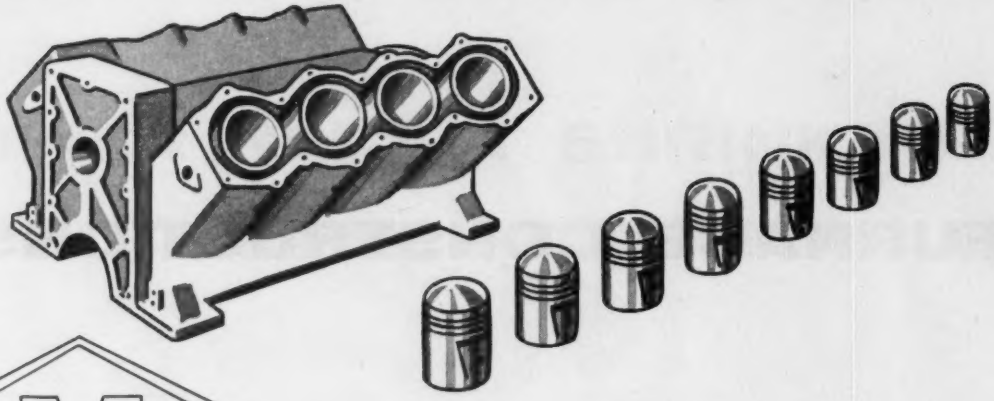
B&W

THE BABCOCK & WILCOX COMPANY

REFRACTORIES DIVISION

For More Information Circle 581, Page 39

From pistons to engine blocks...



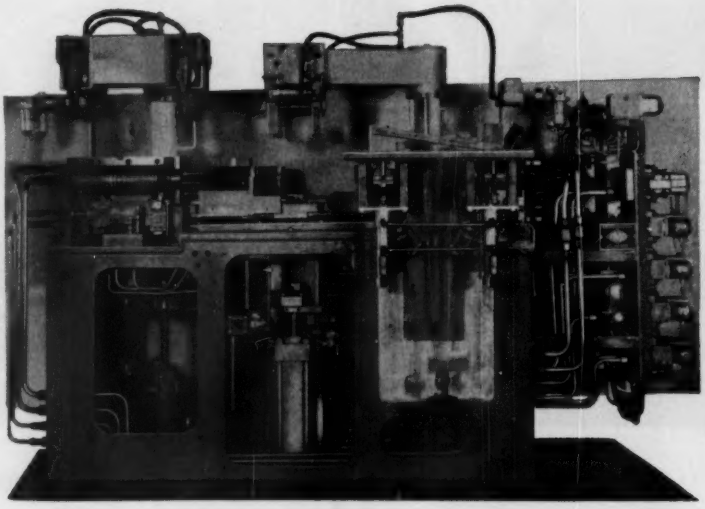
PMD Automated Molding Equipment increases production, lowers costs

The designing and building of special automated molding equipment is an important part of the work at Permanent Mold Die Co. Typical of the equipment that PMD has developed for industry is this Automated Piston Molding Machine.

This machine incorporates the advantages of metal molds and cores, manual or automatic operation, and adaptability to various sizes of pistons. It has increased the rate of piston production almost 600%.

The automatic cycle on this particular machine includes insertion of dimension-control bands into the mold, assembly and disassembly of molds and cores, and transfer of completed pistons to customer's chute or belt conveyor. These PMD machines are designed to operate in groups of two, utilizing a single operator. The operator can pour at one machine during piston solidification at the other. These machines are also adaptable to automatic ladling. Most of the processes of this machine are hydraulically actuated and all the electric, hydraulic, and pneumatic functions conform to Joint Industry Conference Standards.

The machines developed and built by Permanent Mold Die Co., can produce small parts such as pistons, as well as large automotive aluminum castings. This equipment is developed to your specifications, to meet your particular needs.



PMD automated molding equipment offers you a wider production potential at relatively low cost. Investigate its advantages for your operation.

WRITE TODAY FOR DESCRIPTIVE BROCHURE

PERMANENT MOLD DIE COMPANY

2275 E. Nine Mile Rd. • Warren, Michigan • Phone: SLocum 7-8100

For More Information Circle 582, Page 39

Circle 583, Page 39→

BOOM-
ING IS THE
WORD
FOR
LIFT

YOU CAN PROFIT IN THIS **BOOMING** ALUMINUM CASTINGS MARKET WITH . . . . . **ACT** ALUMINUM CONSULTING TEAM

What is ACT? The Aluminum Consulting Team is an exclusive Kaiser Aluminum customer service designed to provide expert assistance in all phases of the production of aluminum castings. This includes the successful installation of an aluminum casting operation in an existing gray iron foundry . . . as well as technical assistance to customers on foundry practices, product engineering, product design and product marketing. These services are designed to increase your aluminum casting sales.

Why ACT? ACT has been created to help qualified foundries take advantage of the present and anticipated demands for aluminum castings. MODERN CASTINGS, official journal of the American Foundrymen's Society, in its January, 1961 issue headlined it this way: "Bright future forecast for aluminum castings . . . Industry leaders predict up to 300 per cent growth in next five years . . . Applications are almost unlimited where light weight and corrosion resistance are needed."

How ACT can help you: For foundries NOW casting aluminum or those interested in STARTING an aluminum castings operation . . . ACT can offer:

1. ASSISTANCE FOR QUALIFIED FOUNDRIES NOW CASTING ALUMINUM

a. *FOUNDRY ASSISTANCE*—In this area ACT will render expert technical assistance in melting and fluxing practices, die and pattern design, proper gating, use of different alloys . . . their characteristics and behavior during and after casting . . . risering techniques, finishing operations and provide insights into castings defects stressing causes, effects and prevention.

b. *PRODUCT ENGINEERING*—ACT will help foundries take advantage of the unique combination of properties offered by aluminum castings. Kaiser Aluminum's long experience with the design of aluminum castings for thousands of diverse applications can be put to work immediately. ACT will make engineering recommendations to assure that the casting withstands the stresses applied in service. This includes counsel on the compatibility of the aluminum casting to other components. This product engineering service also helps minimize scrap losses.

c. *PRODUCT DESIGN*—Here is an area of ACT assistance that can help make products more marketable by making use of the many inherent design advantages of aluminum. ACT can help in choosing from the many available finishing techniques. Aluminum's light weight, high strength and yield characteristics add up to an appealing and more salable design.

d. *PRODUCT MARKETING*—ACT can help find new, better and larger markets for aluminum castings or suggest new products for current markets. Qualified foundries will be supplied with data on any specific market, and assistance in market research that will indicate the size and potential of the market, competition and relative profitability.

2. ASSISTANCE FOR FOUNDRIES NOT CASTING ALUMINUM

a. *FOUNDRY DESIGN*—ACT will offer, to qualified respondents, engineering assistance in setting up an aluminum foundry. This includes expert technical service in plant or department layout, equipment recommendations, melting and fluxing practices, die and pattern design, proper gating, the use of different alloys and many other proven aluminum foundry techniques.

b. *ASSISTANCE IN SWITCHING YOUR CUSTOMERS TO ALUMINUM CASTINGS*—ACT will assist you in converting your customers' castings to aluminum. Conversions of this type are given special attention in areas of redesigning molds to provide desired product strength, performance and appearance.

c. *FOUNDRY ASSISTANCE: PRODUCT ENGINEERING, DESIGN AND MARKETING*—ACT assistance in the major areas outlined above is, of course, available to assist your new aluminum foundry operation. *SPECIAL NOTE:* Kaiser Aluminum & Chemical Corporation will dispatch acknowledged experts to study individual problems and render specialized services. Under these circumstances, only a reasonable number of qualified foundries can be served over any given period. Applications for ACT foundry assistance will therefore be reviewed on an individual basis and assigned a priority.

HOW YOU GET INTO THE ACT: To find out more about this new concept in expert foundry assistance . . . fill out the attached card. The ACT booklet with the details of Kaiser's Foundry Assistance program will be mailed to you immediately.

KAISER ALUMINUM

New Leadership in the World of Aluminum

See HONG KONG and MAVERICK, ABC-TV Network

SEND ME THE FREE ACT BOOKLET which contains complete information about Kaiser Aluminum's new ACT program, plus an application for technical assistance.

NAME. . . . . TITLE. . . . . .

COMPANY. . . . . .

ADDRESS. . . . . .

CITY. . . . . ZONE. . . . STATE. . . . . .

Where belts carrying hot sand now last 50% longer

THOSE men are dumping hot sand from molds into a shake-out grid. The 250-degree sand falls through the grid and down on a conveyor belt nine feet below. But the heat is so intense it even blistered and scorched rubber belts that were supposed to have been specially designed for hot-material service. Belts were only lasting 3 or 4 months.

When a B.F.Goodrich man heard of the problem, he recommended a new conveyor belt called Solarflex. This B.F.Goodrich belt is made of a special rubber that stays soft and pliable at temperatures that cause other belts to harden, crack and finally break down.

Since 1954, B.F.Goodrich Solarflex belts have been used exclusively on this job. Because of their greater resistance to heat, they last from six to nine months—a 50% increase in belt life.

In this plant, the maintenance supervisor had a good rule which hundreds of others like him follow. Instead of accepting the high cost of frequent replacements, he called in a B.F.Goodrich representative and found exactly what he needed to cut costs and keep the foundry running with fewer shutdowns and delays.

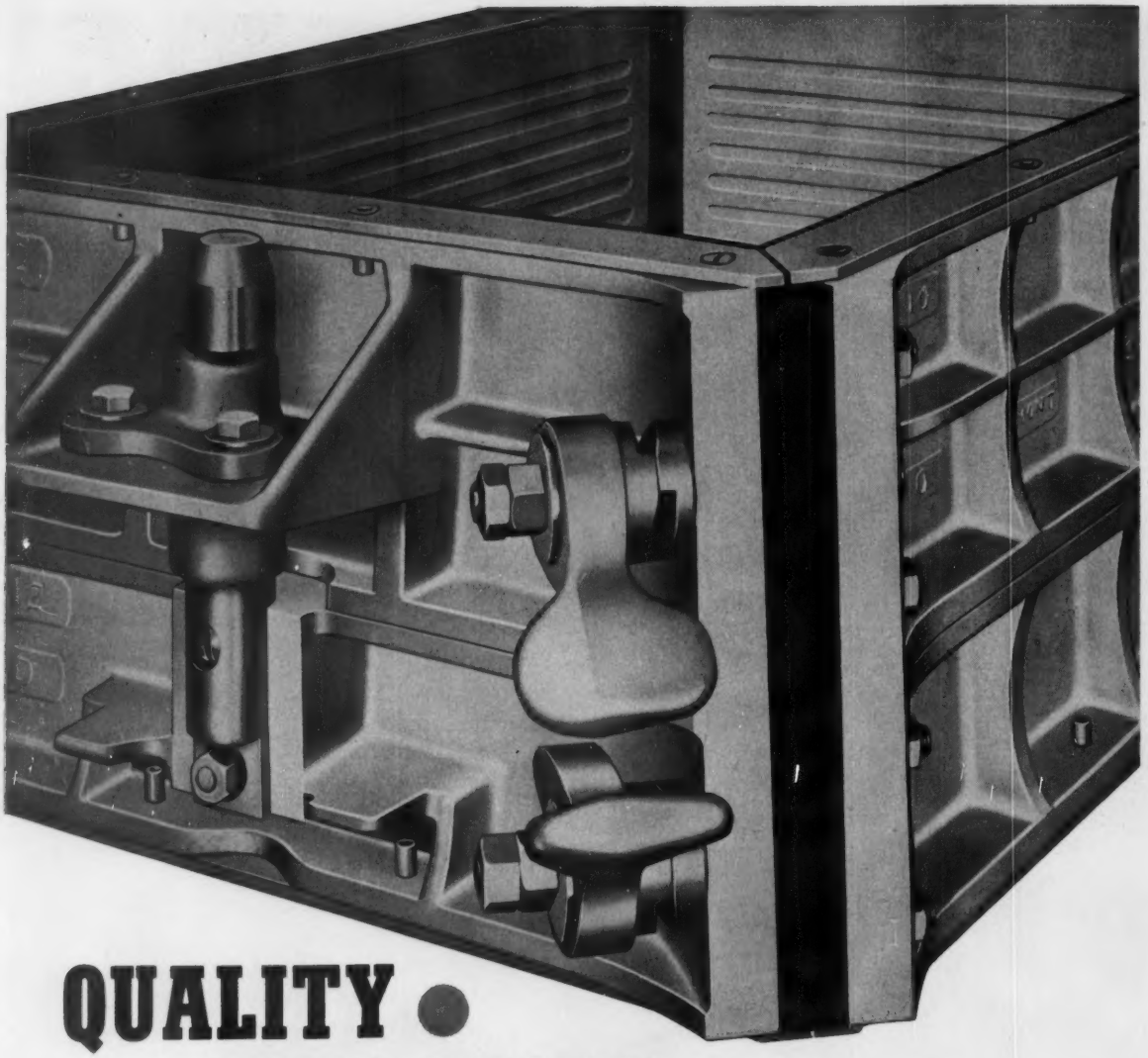
Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich belt described here. And, as a factory-trained specialist in rubber products, he can answer your questions about the many rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-993, Akron 18, Ohio.*

B.F.Goodrich

CONVEYOR BELTS

←Circle 583, Page 39

For More Information Circle 590, Page 39



QUALITY •
STRENGTH •
REPUTATION •
THOUSANDS IN USE •

That about sums up the story of Fremont flasks and jackets

THE

FREMONT

FLASK CO., FREMONT, O.

For More Information Circle 591, Page 39

THE PURECO CO_2 "BLUE LINE"

cuts core hardening time from hours to seconds

SAVE WITH PURECO CO_2 "FLASH CURING"

The Pure Blue Line of quality running to your core shooter, core box or mold means extensive savings in time and money. The Pureco CO_2 "*Flash Curing*" process cuts hardening time from hours to seconds . . . no costly baking ovens are needed . . . valuable space is saved . . . more accurate castings with smoother finish result. Mold drying is eliminated . . . rapid production of finished cores expedites rush orders. In-plant handling time is drastically reduced.

"Flash Curing" installation simple.

Pureco can tailor a "*Flash Curing*" installation for production or custom work to meet your specific foundry requirements—large or small. Cost is low—installation simple.

Have a "Flash Curing" demonstration!

Pureco would like to demonstrate its "*Flash Curing*" process in your foundry under your working conditions, with no obligation on your part. Call your local Pureco man or write:

PURECO CO_2

PURE CARBONIC

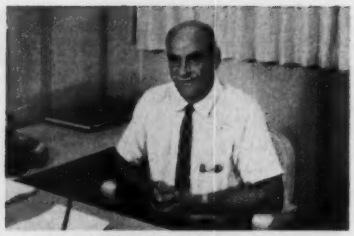
Pure Carbonic Company, A Division of Air Reduction Company, Incorporated

Nation-Wide Pureco CO_2 Service-Distributing Stations in Principal Cities

General Offices: 150 East 42nd Street, New York 17, N.Y.

For More Information Circle 592, Page 39

Yes! Progressive Foundries Prefer WHIRL-AIR-FLOW Pneumatic Sand Conveyors

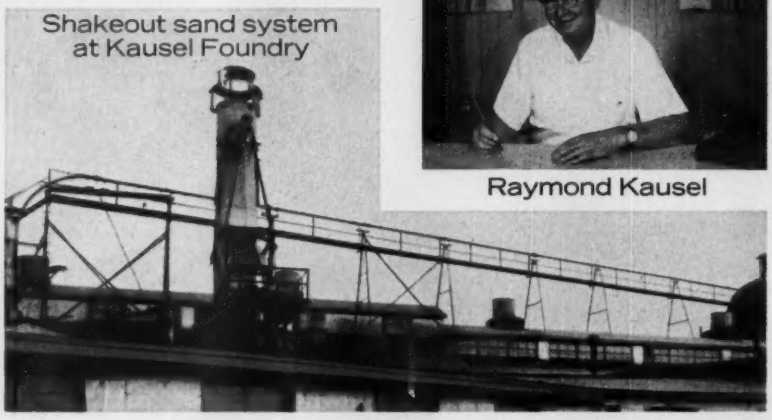


Charles Kausel

Raymond Kausel

Charles and Raymond Kausel, owners of the successful Kausel Foundry Co., Minneapolis, give these reasons why they are using Whirl-Air-Flow:

- **Lower first cost**
- **Greater layout flexibility**
- **More efficiency**
- **Cleaner operation**
- **Lower maintenance**



Shakeout sand system at Kausel Foundry

Here are the three pneumatic systems that complete mechanization at the Kausel foundry:

A

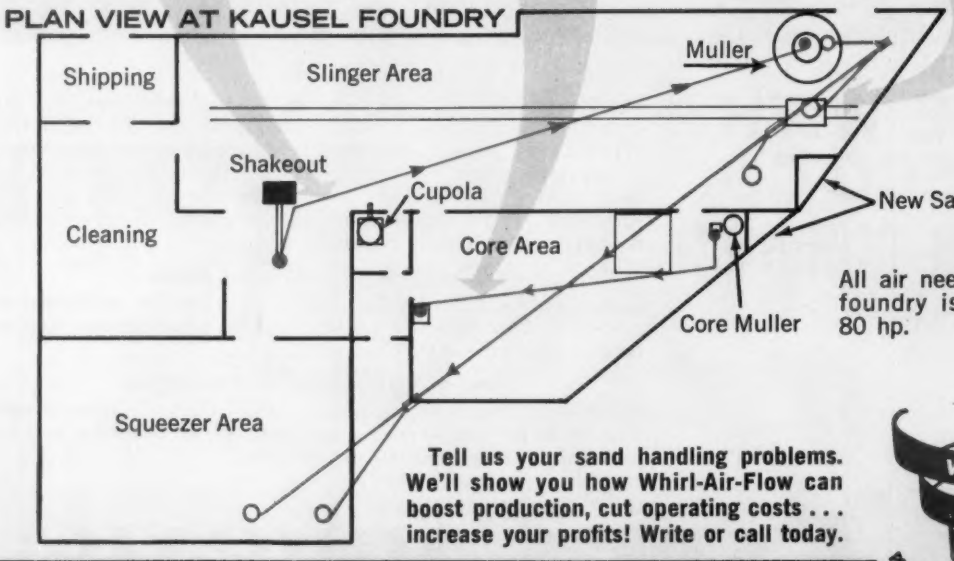
Shakeout sand transported 200 feet to storage over muller. Rate of transport is 35 tons per hour. Has been in operation three years with **only three pipe sections replaced!**

B

Core sand transported 90 feet to central core room hopper. Has been operated two and one-half years with **no pipe replacement!**

C

New molding sand delivery to slinger hopper and four molders stations. Is final step in this program . . . shows practicality of step-by-step Whirl-Air-Flow installation!



All air needed at Kausel foundry is supplied by 80 hp.

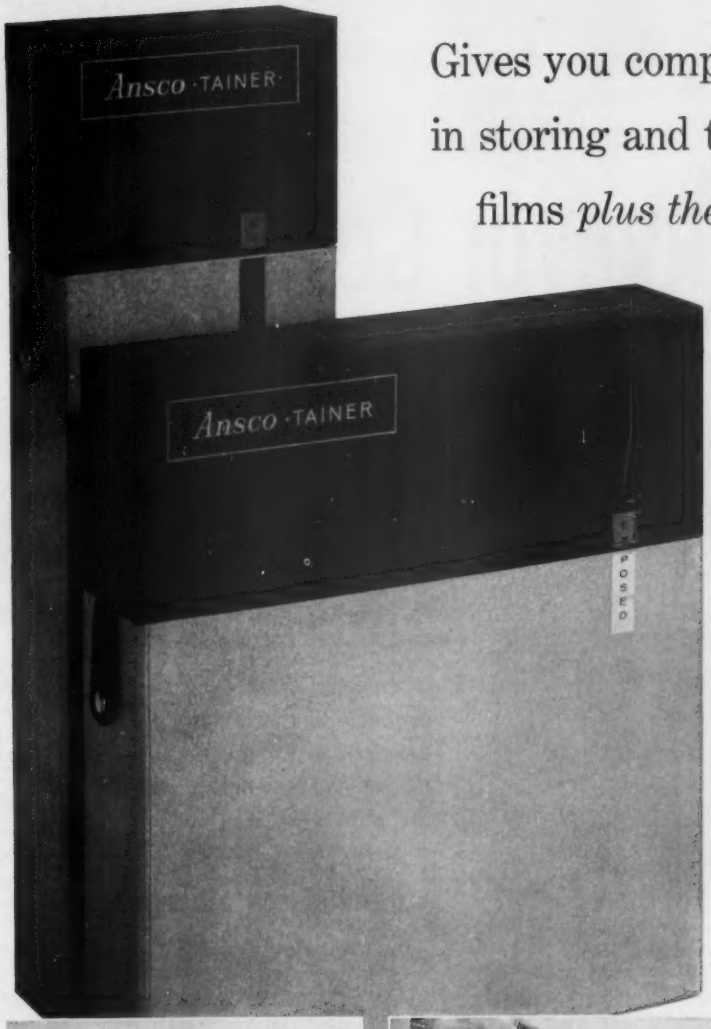
Tell us your sand handling problems. We'll show you how Whirl-Air-Flow can boost production, cut operating costs . . . increase your profits! Write or call today.

WHIRL AIR FLOW PNEUMATIC CONVEYORS

WHIRL-AIR-FLOW

650 - 25th Avenue S.E., Minneapolis 14, Minn. • FEderal 9-0231

NEW ANSCO-TAINER!



Gives you complete safety in storing and transporting X-ray films *plus these important extras:*

1. Lightweight—strength without bulk.

2. Light-tight—completely light sealed.

3. Superior construction—protects film against artifacts.

4. Durable—Long-wearing plastic finish resistant to stains.

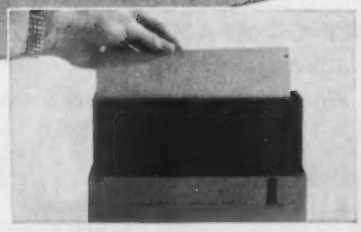
5. Perfect size—carries just the right amount of film needed to do the job . . . will hold a 75 sheet interleaved or 150 sheet non-interleaved Pouchpak from a Superpak or Bulkpak® carton.

6. Economy—costs far less than expensive suitcase containers.

7. Easier darkroom handling—cover opens and closes with ease in dark.

But the new ANSCO-TAINER has to be seen to be appreciated! Handsome, versatile, the perfect darkroom-to-equipment-area X-ray film carrier. Pack it, pick it up and go . . . no bulky cases when bulk is unnecessary. As protective and as safe for your film, as the darkroom itself! Ansco, Binghamton, New York, A Division of General Aniline & Film Corporation.

Versatile—the Ansco-Tainer is the right size for most jobs. Holds a complete Pouchpak from a Superpak or Bulkpak carton.



A few sheets or a single sheet . . . complete safety for exposed or unexposed film, with all the convenience of total portability.

Ansco

X-ray

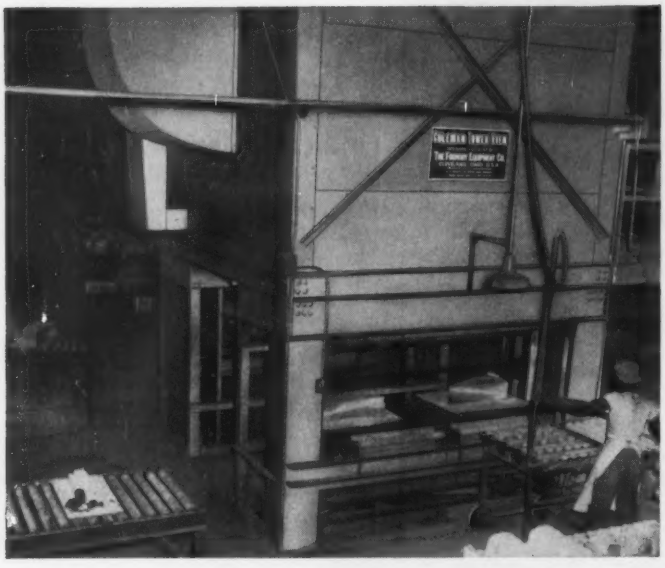
For More Information Circle 594, Page 39

CUT LABOR COSTS

with

Coleman Dielectric Core Oven in leading plumbing fixture foundry. Direct labor alone reduced by 75%, with many other important savings and advantages.

Coleman Conveyor Core Ovens



Coleman Tower® Core Oven. One of two large installations in a major steel foundry. Mechanized handling and baking of cores up to 150 pounds at substantial annual savings.

● **Performance records in all types of foundries prove that Coleman Conveyor Core Ovens reduce core department costs by as much as 50%!**

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

As builders of the world's only complete line of foundry ovens . . . dielectric or recirculating heat . . . we can recommend, without bias, the right oven for your particular needs.

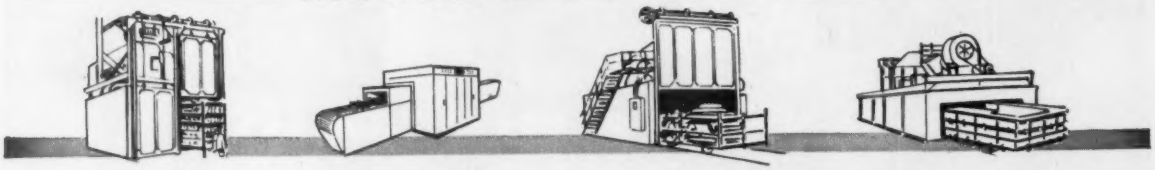
WRITE FOR BULLETIN 54

FEMA

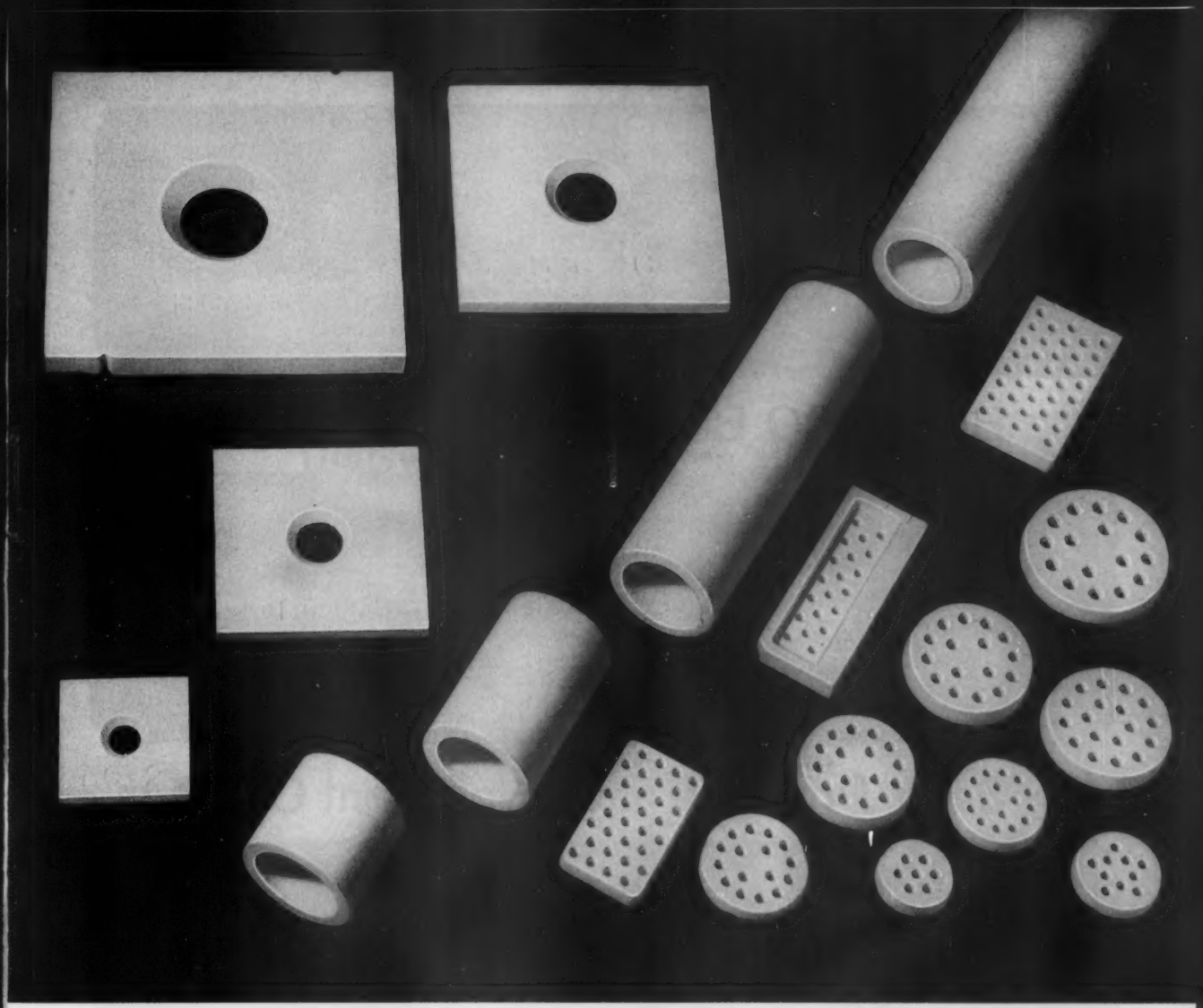
THE FOUNDRY EQUIPMENT COMPANY • **1821 COLUMBUS ROAD, CLEVELAND 13, OHIO**

World's Oldest and Largest Foundry Oven Specialists—More than half a century of specialized foundry experience.

PART OF THE WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS



TRANSRACK OVENS **DIELECTRIC CORE OVENS** **CAR TYPE OVENS** **JET ACTION MOLD OVENS**



what users like best about

Louthan gating and risering refractories . . .

There's a good reason why Louthan is making more and more refractories for the foundry field. *Users like them,* like the way they perform on the job, like the cost reductions they make possible.

Louthan Strainer Cores are now available in more sizes and shapes—and for *steel, iron, brass* and *bronze* castings. All provide an accurate choke for positive control of metal flow, eliminate slag and oxide inclusions.

Louthan Breaker Cores facilitate rapid removal of the riser with subsequent labor savings. There is no core gas. You get cleaner castings. Available for all riser diameters from 2″ to 12″, and for use with *any metal casting* risering from a flat surface.

Louthan Gate Tiles prevent erosion of the gates in steel castings. They safely withstand high temperatures, will not react with the molten metal. All popular diameters and lengths can be furnished, also elbows and tees to match.

FREE: Write for this new Louthan product booklet. You'll find that our products match your needs and perform the way you like them to.

LOUTHAN . . . EAST LIVERPOOL, OHIO

a unit of FERRO CORPORATION . . . *Refractories Division*

REPRESENTATIVES: M. A. BELL COMPANY, St. Louis 2, Mo. . . Houston 3, Texas; **MILWAUKEE CHAPLET & SUPPLY CORP.,** Milwaukee 46, Wisc. . . **FREDERIC B. STEVENS INC.,** Detroit 16, Mich. . . Indianapolis 7, Ind. . . . Buffalo, N. Y.; **FOUNDRY SPECIALTIES COMPANY,** Chicago 38, Illinois

For More Information Circle 596, Page 39

BERYLCO Beryllium Copper Alloys

For Sand, Pressure and Investment Castings

Hard as Steel, With Fine Fluidity, Detail, Castability and Ease of Handling

BERYLCO casting alloys offer you a combination of properties, not just outstanding, but actually unique. The strength of steel, the electrical conductivity of copper, high resistance to corrosion and wear . . . all these and other characteristics become part of the casting . . . without creating problems for the foundryman.

In sand, investment or pressure casting, the fluidity of molten BERYLCO beryllium copper alloys is excellent. Intricate detail can be obtained in parts "as cast". Low pouring temperature and castability provide distinct foundry advantages over ferrous and non-ferrous materials with comparable physical and mechanical properties.

At BERYLCO, we maintain a complete organization of specialists available to you for technical information and assistance in any phase of beryllium copper casting. These service aides are experienced men who know foundries and come prepared to solve problems. BERYLCO beryllium copper casting alloys have been developed to solve problems. Write today for detailed information on the advantages applicable in your own foundry.

BERYLCO®

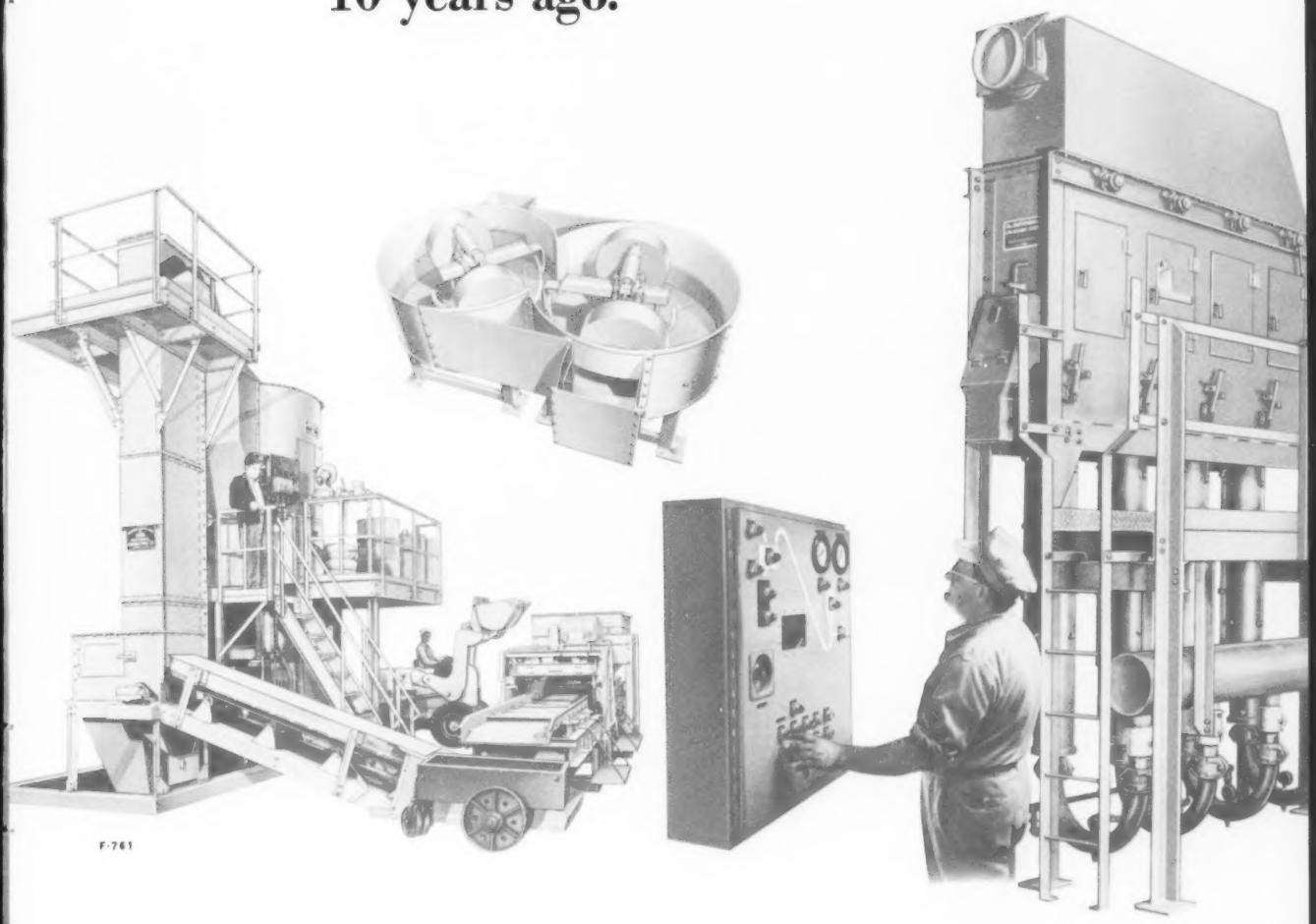
THE BERYLLIUM CORPORATION

Reading, Pennsylvania

For More Information Circle 597, Page 39

Circle 598, Page 39→

Foundrymen are winning the battle of profit vs. cost with National equipment that was only an idea 10 years ago.



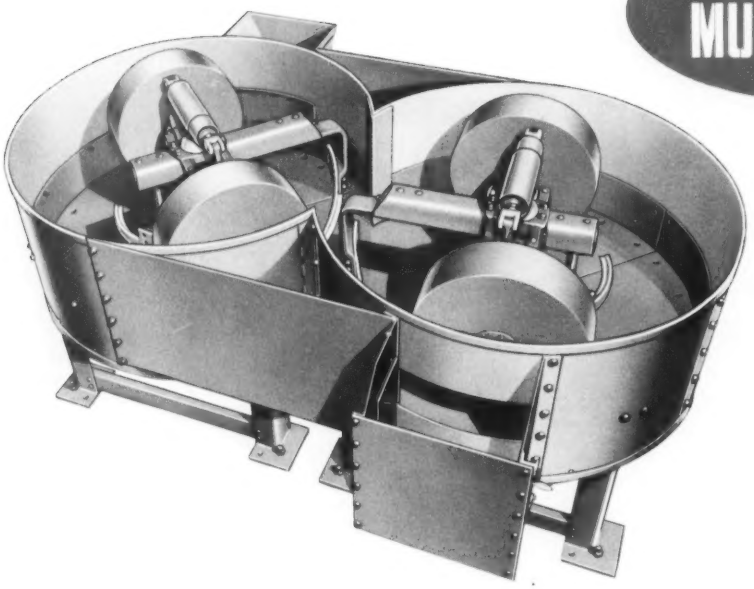
F-761

National prospers only as foundrymen prosper . . . through the acceptance of improved technology and the development and use of equipment designed to reduce the cost of processing and handling your most expensive commodity: SAND.

NATIONAL ENGINEERING COMPANY • Chicago 6, Illinois

I mull sand the new way . . .
Continuously:
I do it carefully and thoroughly
and, I'm big enough
or small enough . . .
to meet *any* molding requirement.

SIMPSON
MULTI-MULL



Foundrymen who are aggressively waging the battle of cost vs. quality are winning—with Simpson Multi-Mull.

Can you afford to overlook the competitive advantages of continuous and controlled mulling?

Conveyor: 1961

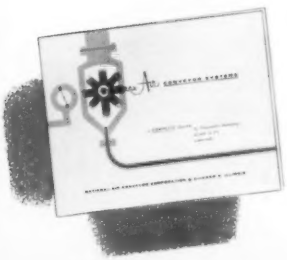
Pipe line routing serves to conserve the foundryman's most valuable asset: manpower and real estate,

. . . by reducing the cost of handling his most expensive commodity:

Sand

Can you afford to overlook the competitive advantages of reducing your sand handling costs?

Foundrymen who are aggressively waging the battle of cost vs. profit are winning—with National Air Conveyor Systems. Write for literature.



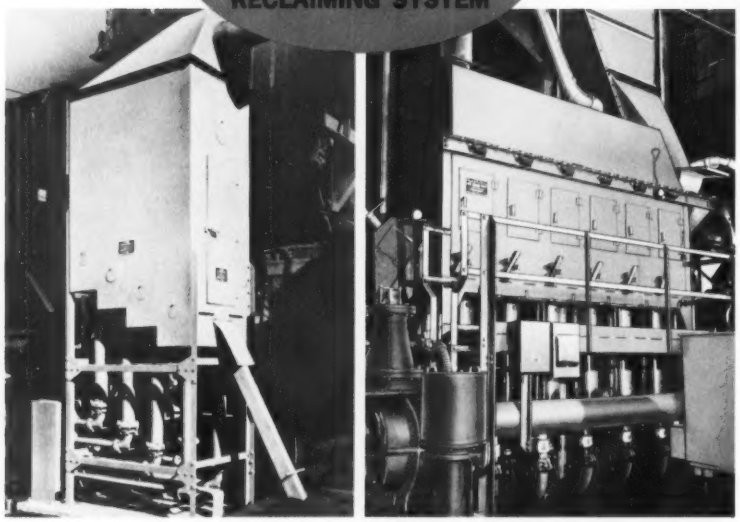
In 10 years, National has brought sand reclamation of age.

Every day thousands of dollars are being saved in our foundry industry.

...because 70 National units are in use.

Your 1961 National system will come complete with classifier, rotary screen and individual cell controls.

NATIONAL
EVEN-FLO
RECLAIMING SYSTEM



1951:
A Sand Scrubber unit

TODAY:
An integrated Sand Reclaiming System.

See this equipment in action during the 65th Casting Congress in San Francisco, May 8–12. Don't miss the SIMPSON FOUNDRY CARAVAN.

Foundrymen who are aggressively waging the battle of profit vs. cost are winning with the National System.

There is a unit near you . . . Ask your National agent to show it to you . . . Write for literature.

NATIONAL ENGINEERING COMPANY

Machinery Hall Building • Chicago 6, Illinois

here's why

YOU CAN'T AFFORD OLD-STYLE RAMMERS!

I-R Size 241
Sand Wiper Floor Rammer

NEW SAND WIPER FEATURE ON IR RAMMERS CONVINCES ONE OF WORLD'S LARGEST FOUNDRIES

A tiny $1.35 repair bill after almost 1500 hours of continuous service (about 9 months on an average job) was all the proof they needed. This was the total cost of a replacement *Sand Wiper* piston seal that was designed to fail before allowing sand or abrasive grit to enter the air cylinder.

Without *Sand Wiper* protection, no rammer can give you this kind of economical, trouble-free service. And *Sand Wiper* is an exclusive I-R Air Engineering Extra! Others:

- **Piston Rod Air Seal**
  Provides positive air-tight seal around piston rod with minimum of friction.
- **Continuous Lubrication**
  From built-in grease chamber that keeps piston rod lubricated.
- **Chrome-Plated Piston**
  Rides in smoothly honed pearlitic iron barrel to reduce friction losses by 65%.
- **Built-In Cooling**
  Cooled exhaust air keeps barrel from getting hot at the grip.
- **Rubber-Faced Throttle Valve**
  Neoprene valve face prevents air leaks common in metal-to-metal seals.

For more details or a convincing demonstration of these money-saving Air Engineering Extras, call your nearby I-R representative.

62A-8

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

Planned Annual Retooling increases output per man

←Circle 598 on Page 39

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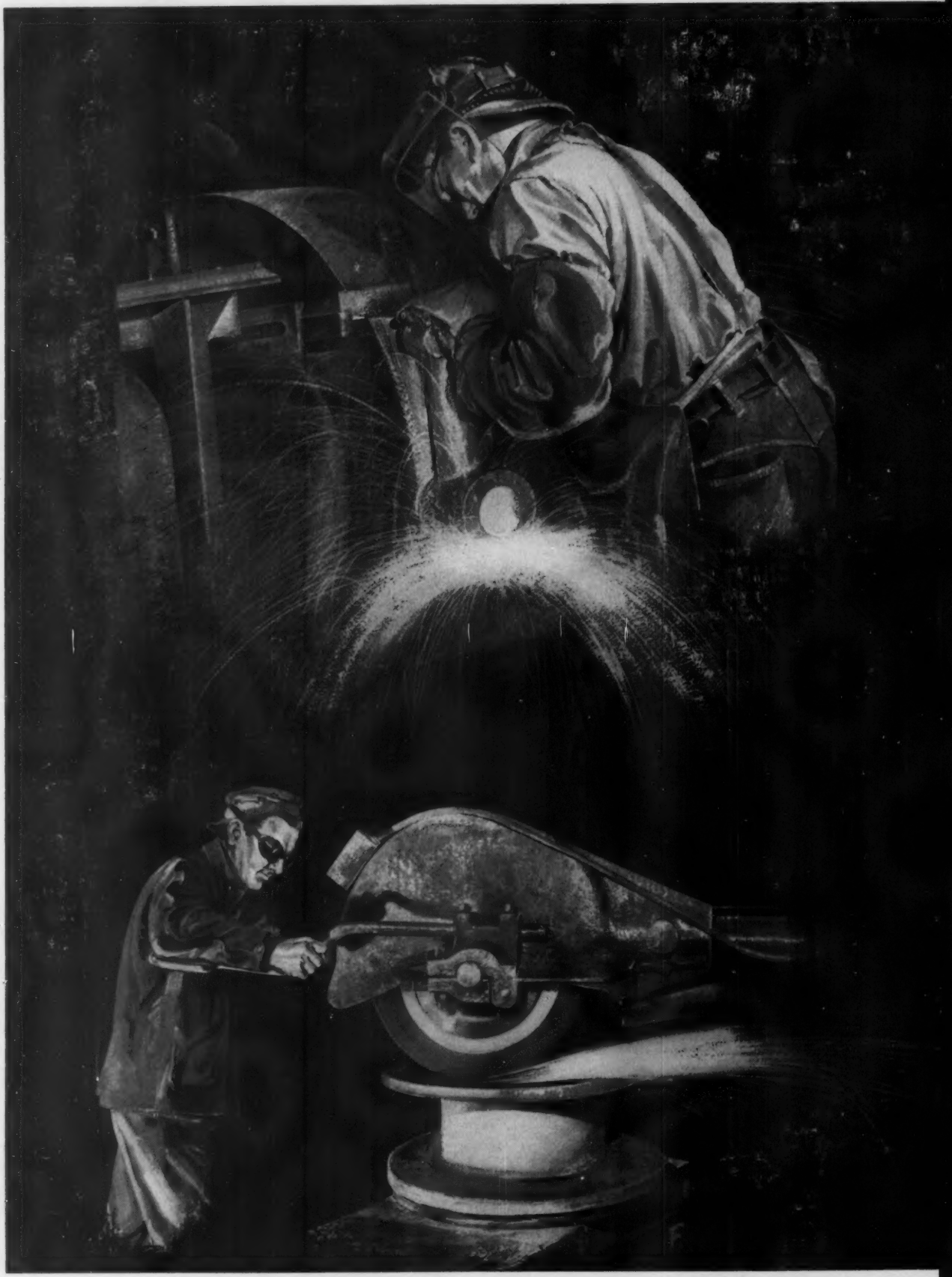


Give economy a real workout in your cleaning room

. . . test 44 ALUNDUM B11 wheels against all others*

Test Norton 44 ALUNDUM B11 wheels on your floor stands, swing frames and portables. Compare the results these wheels give you — including wheel costs, work per wheel and time per job — with any other wheel data. Then judge for yourself how these Norton wheels bring improved economy to cleaning room operations.

44 ALUNDUM abrasive is standard priced. But this is no ordinary aluminum oxide. It is made differently — by special Norton electric furnace processing that makes it much denser and tougher. And it performs differently — cutting faster, lasting longer and producing more work than ordinary aluminum oxide abrasive.

The Norton B11 resinoid bond is an equally important improvement for snagging. It assures more uniform wheel structure and better balance, resulting in cooler, faster grinding. And B11 wheels are available in half-grade increments of hardness, making it easier to choose exactly the right wheels for each job.

Your Norton Man, a trained specialist in foundry grinding, will be glad to arrange a test of 44 ALUNDUM B11 wheels in your plant for grinding steel castings — or of regular ALUNDUM B11 wheels for grinding annealed malleable iron castings. See your Norton Distributor, or write to NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

W-2013

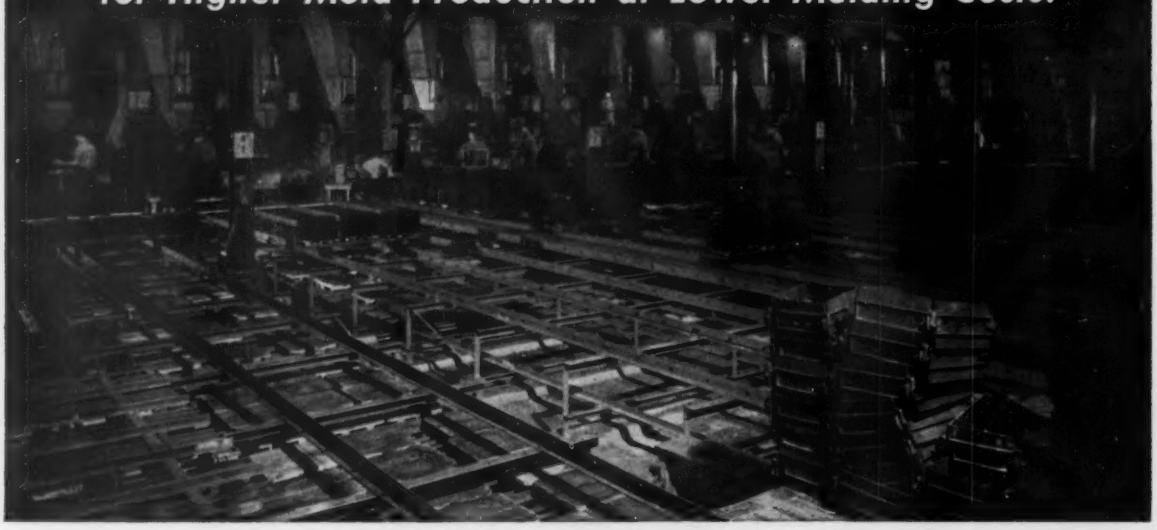
Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Newaygo Engineering Company — Leaders in

PALLET LINE SYSTEMS OF MOLD HANDLING

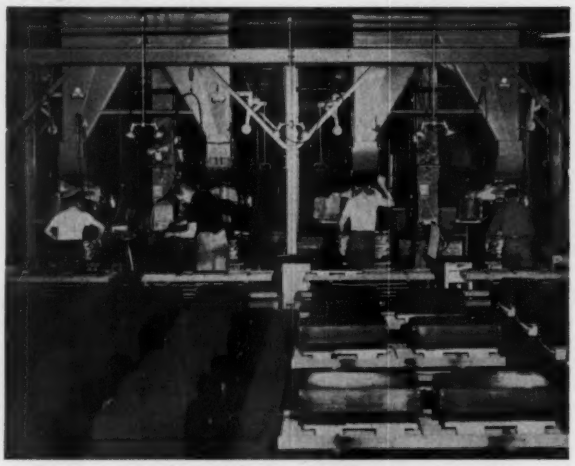
for Higher Mold Production at Lower Molding Costs!



As of October, 1959, heavy duty foundry installations in operation total close to TEN THOUSAND LINEAL FEET of Newaygo Pallet Line Systems, consisting of top set out track, automatic mold discharge, and underneath car return, — operating approximately 5,600 Pallet Cars; — which, using average rates of production for molders using these lines and cars, means that these Pallet Line Systems are producing an average of 42,500 molds per working day, for approximately 10,200,000 molds per year!

Projecting the average amount of metal poured in molds by these systems, around 1,200,000 pounds of castings are produced per day, or approximately 300,000,000 pounds or 150,000 net tons of castings per year.

One foundry reports the outstanding performance of Newaygo's Pallet Line System by averaging 450 molds per 7½-hour day per man, using a 14" x 16" x 12" deep mold. This yields a mold per minute per man, and each man is making the complete mold in snap flasks and setting his own cores.



Pallet Lines in action with Handy Sandy units at Universal Foundry Co. Photo above shows four of the eight lines in operation.

The presentation of "NEWAYGO PALLET LINE SYSTEMS FOR MOLD HANDLING" is yours for the asking, in a 16mm, 25-minute MOVIE, which shows many types of Pallet Line installations in foundries.

NEWAYGO engineering company
NEWAYGO, MICHIGAN

. . . and profitable, too, with **NEWAY® MOLD HANDLING, SAND HANDLING AND CONDITIONING EQUIPMENT**

Also Manufacturers and Installers of MULTI-LEVEL HOPPER CONTROL SYSTEMS, CAR CONVEYORS, APRON CONVEYORS, ROTARY FEEDERS, and FOUNDRY AUTOMATION.

For More Information Circle 601, Page 39

Circle 602 on Page 39→

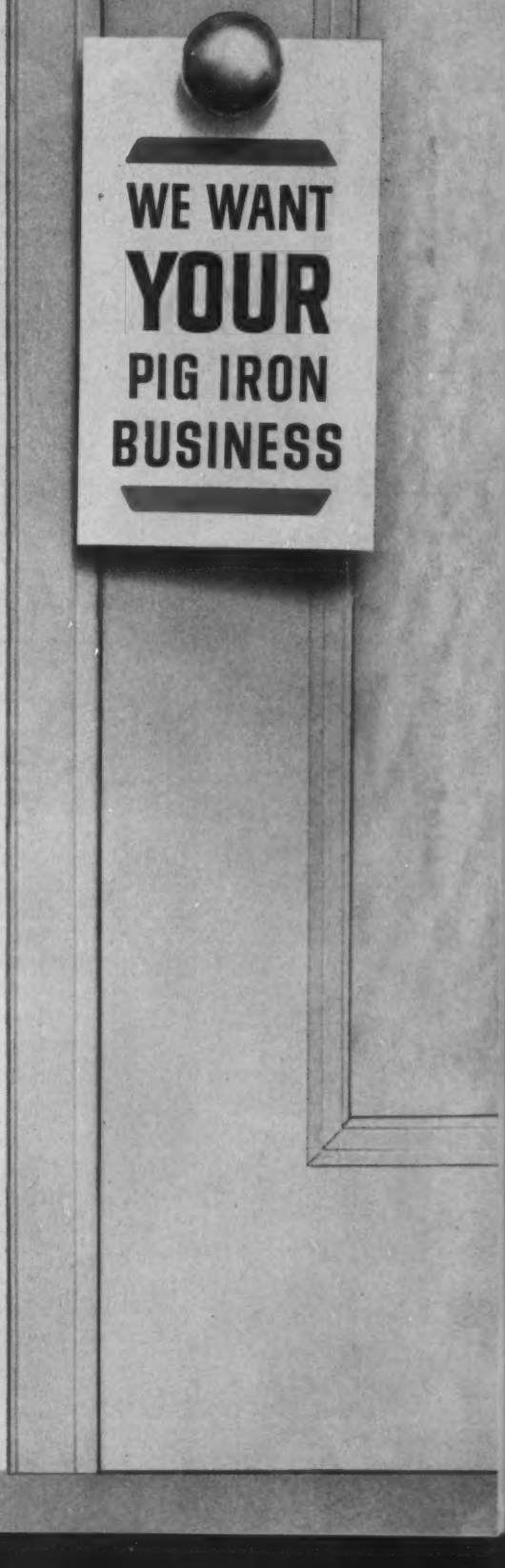
Blunt way to ask for an order? Perhaps, but we believe in the direct approach. In fact, that's the way we deal with all of our customers. *We sell direct*—strictly a furnace-to-foundry operation. But buying direct is just one of the advantages you have when you get your pig iron from our furnaces at Cleveland, Ohio. Another, and equally important advantage is that you will be dealing with an organization whose plant is designed for and devoted exclusively to the production of *merchant* pig iron. As a customer, you have access to an almost unlimited storehouse of United States Steel's metallurgical and technical knowledge. *If you have any problems pertaining to foundry operation, our Foundry Service Metallurgist can undoubtedly help you solve them.* Incidentally, American Steel & Wire does not allocate a single pound of its merchant pig iron output to any United States Steel mill. *All of it is for sale!* American Merchant Pig Iron is produced in one of the industry's largest and most modern plants. It is carefully made from selected raw materials under highest standards of quality control. It features a minimum of "tramp element" contamination; has uniform, well distributed graphite content, and a full percentage of desired elements. You can get American Merchant Pig Iron in 35-lb. pigs . . . in any wanted grade: Basic, Foundry, Malleable, Bessemer, Intermediate and Low Phosphorous, including Low Manganese for Ductile Iron Casting.

To sum up—We have the facilities and the capacity to take care regularly of your immediate and future pig iron requirements. The quality of American Pig Iron is consistently and uniformly high to enable you to produce *consistently* better products.

Weigh what we offer you against what you have been getting. If you want more information, just say so. We will be glad to answer your questions—by mail, phone or in person. And without obligating you in the least. Pig Iron Sales Department, American Steel & Wire, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

USS and American are registered trademarks

USS **American Steel & Wire**
Division of
United States Steel

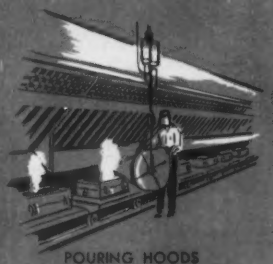


SCHNEIBLE

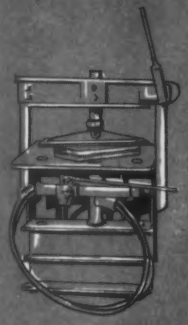
McDANIEL

EQUIPMENT FOR AIR POLLUTION CONTROL AND FLASK SALVAGING*

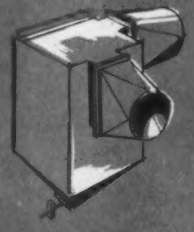
SHAKEOUT HOODS



POURING HOODS



FLASKONDITIONER



VELOCITRAPS

***NEW FLASKONDITIONER—saves money by reconditioning and extending the useful life of flasks. FLASKONDITIONER straightens bent, out-of-shape flasks; allows checking and correction of sand joints; aligns pin centers and replaces worn pins and bushings.**

THE MULTI-WASH COLLECTOR, long a standard with foundries, and, the NEW MULTI-DYNE DRY COLLECTOR, a general purpose unit. Capacities range from 500 to 50,000 cfm for Multi-Wash, and up to 8,000 cfm for Multi-Dyne collectors.

A WIDE VARIETY OF HOODS are available for pouring and other work station operations—from the standard UNI-FLO hoods to COMPENSATING-FRACTIONATING hoods that provide efficient control of all plant air in any season.

SCHNEIBLE "SW" CUPOLA COLLECTORS are used in more foundries than any other make. Efficiency and economy has made the "SW" a standard with the industry. The "SW" meets code requirements in practically all areas.

SLUDGE COLLECTION TANKS are offered in many types—from small dewatering tanks with sludge conveyors, to large volume concrete settling tanks for multi-unit systems.

THE VELOCITRAP is especially adapted for use on grinding and chipping operations. This unit collects large abrasive particles and reduces wear on ductwork.

Schneible can help increase efficiency and economy in your foundry. Write or phone for an engineering consultation on your problem.

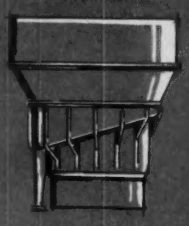
CLAUDE B. SCHNEIBLE CO.

Box 296, Roosevelt Pk. Annex
Detroit 32, Michigan • TAshmoo 5-7772

ASME PRESSURE VESSELS, STORAGE TANKS or custom-built tanks of plate or sheet metal are provided through our facilities at the McDaniel Tank Division. Write or phone for complete information.

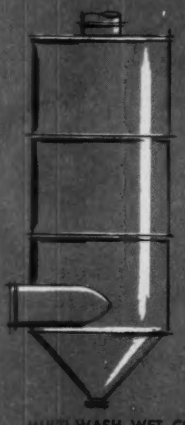
McDANIEL TANK MFG CO.

Holly, Michigan **MElrose 4-6531**

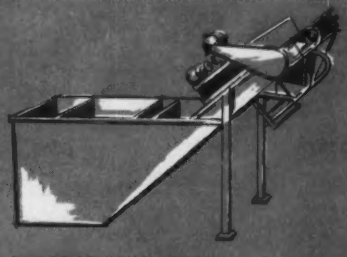


SW CUPOLA COLLECTORS

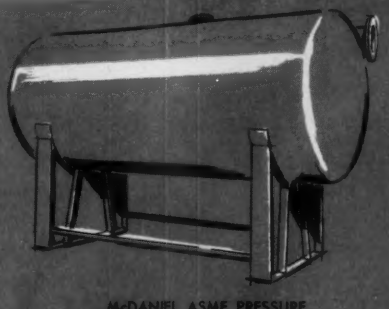
MULTI-DYNE DRY COLLECTORS



MULTI-WASH WET COLLECTORS



SLUDGE CONVEYOR TANKS



McDANIEL ASME PRESSURE VESSELS-STORAGE TANKS

For Your Power Drive • Design • Application or Replacement Maintenance

There's a T-J CYLINDER

That Can Assure *Accurate Efficient Operation*

Only T-J's complete line can assure you a cylinder of either air or hydraulic application—with practically limitless design specifications for bore, stroke, pressure range and even delivery requirement. From the time-tested, standard tie-rod air and hydraulic, to the exclusive T-J Spacemaker, and including the recently introduced Squair Head, T-J cylinders give you more features for efficient, long-lasting operation. Write today!

Plus

THE ONLY COMPLETE ENGINEERING CATALOG LINE, TOO!

H-47 for standard tie-rod hydraulic cylinders.

SQ-1058-4 for the T-J Squair Head cylinder.

No. 54 for standard tie-rod air cylinders.

SM-56-3 for the incomparable Spacemaker cylinder.

HSM5-56-4 for the High-Pressure Hydraulic Spacemaker cylinder.

THE TOMKINS • JOHNSON CO. JACKSON, MICH.

CYLINDERS • MILLING CUTTERS • RIVETERS and CLINCHERS

For More Information Circle 604, Page 39

Knight LETTER

SIXTH OF A SERIES

To: Foundry Management

Subject: Foundry Mechanization and Automation

The Knight organization, as you may know, engineered the first fully automated foundry in the United States in 1951. It is producing at the rate of 276 molds per hour with high speed production achieved through semi or fully automatic equipment.

Today's competition makes professional engineering assistance more helpful than ever to foundries. A manufacturing approach, for example, involving segmented and composite patterns offers the most economical production and lowest costs. In one instance, a recent study showed 118 different castings produced, with annual requirements from 1,000 to 105,000 pieces, by using just 30 segmented and composite patterns.

This approach supplies maximum flexibility for scheduling, standardization in one size of flask, and minimum pattern cost. It permits production techniques to be applied to jobbing and jobbing production requirements. In another case, two units replaced eight for the same volume of castings, with a reduction in total man hours per ton of 50%.

For your foundry to be competitive today and tomorrow, planned modernization is essential.

Lester B. Knight

KNIGHT SERVICES INCLUDE:

Foundry Engineering • Construction Management • Modernization • Mechanization • Automation • Survey of Facilities • Materials Handling • Methods • Industrial Engineering • Wage Incentives • Cost Control • Standard Costs • Flexible Budgeting • Production Control • Organization • Marketing

EVIDENCE OF EXPERIENCE

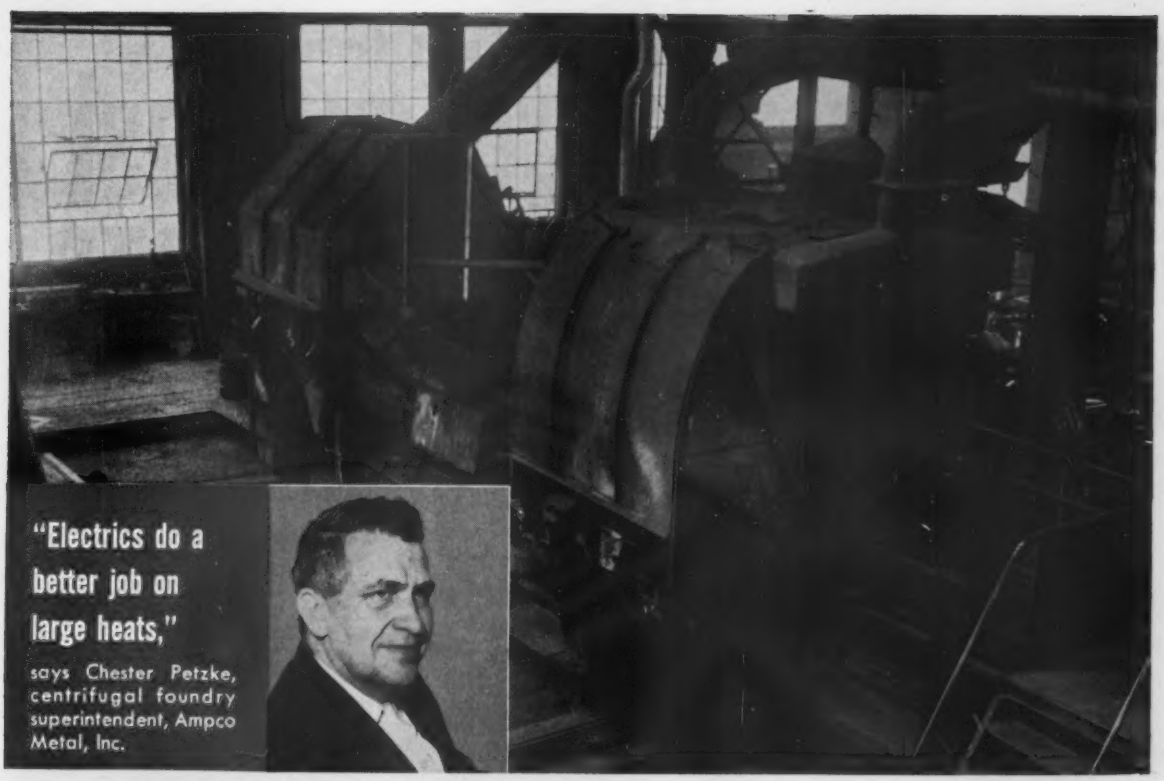
Lester B. Knight & Associates, Inc.

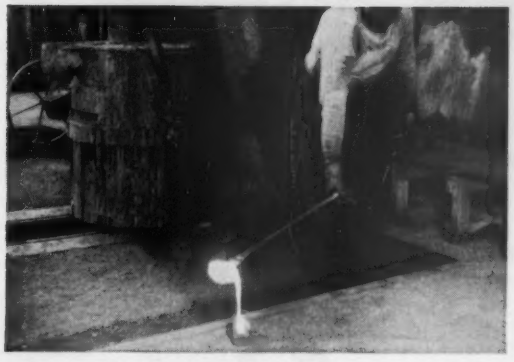
Management, Industrial and Plant Engineers

Member of the Association of Consulting Management Engineers, Inc.

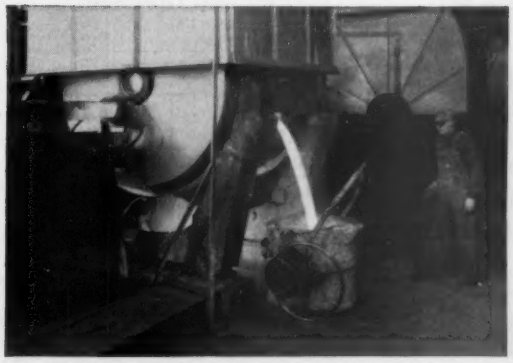
549 W. Randolph St., Chicago 6, Ill.

New York Office—Lester B. Knight & Associates, Inc., Management Consultants, 500 Fifth Ave., New York 36
20111 James Couzens Highway, Detroit 35, Michigan
Knight Engineering A. G. (ZUG) (Zurich Branch), Dreikönigstrasse 21, Zurich, Switzerland
Lester B. Knight & Associates, G.M.B.H., Berliner Allee 47, Düsseldorf, Germany





Test bar is poured to check physical and chemical characteristics of the melt before emptying furnace into ladle.



Detroit Electric Furnaces range from the giant 8000 lb. Type CM shown above to 10-20 lb. Type ICID investment casting furnaces.

DETROIT ELECTRIC FURNACES have a 20-year service record at Ampco

"Ampco has long been a leading producer of bronze castings," says Mr. Petzke. "Most of our melting is done in Detroit rocker-type, electric-arc furnaces."

Detroit Electric Furnaces in service at Ampco range from 1200 pounds capacity to a giant 8000 pounder. Detroit Electrics have been turning out high quality alloys at Ampco for twenty years!

The indirect arc operation of these furnaces guards the melts from contamination, and their rocking action means homogeneity of the molten metal and optimum utilization of heat.

Other advantages of Detroit Electric Furnaces are faster melting, less metal shrinkage, longer lining life, uniform quality melt after melt, lower operating costs.

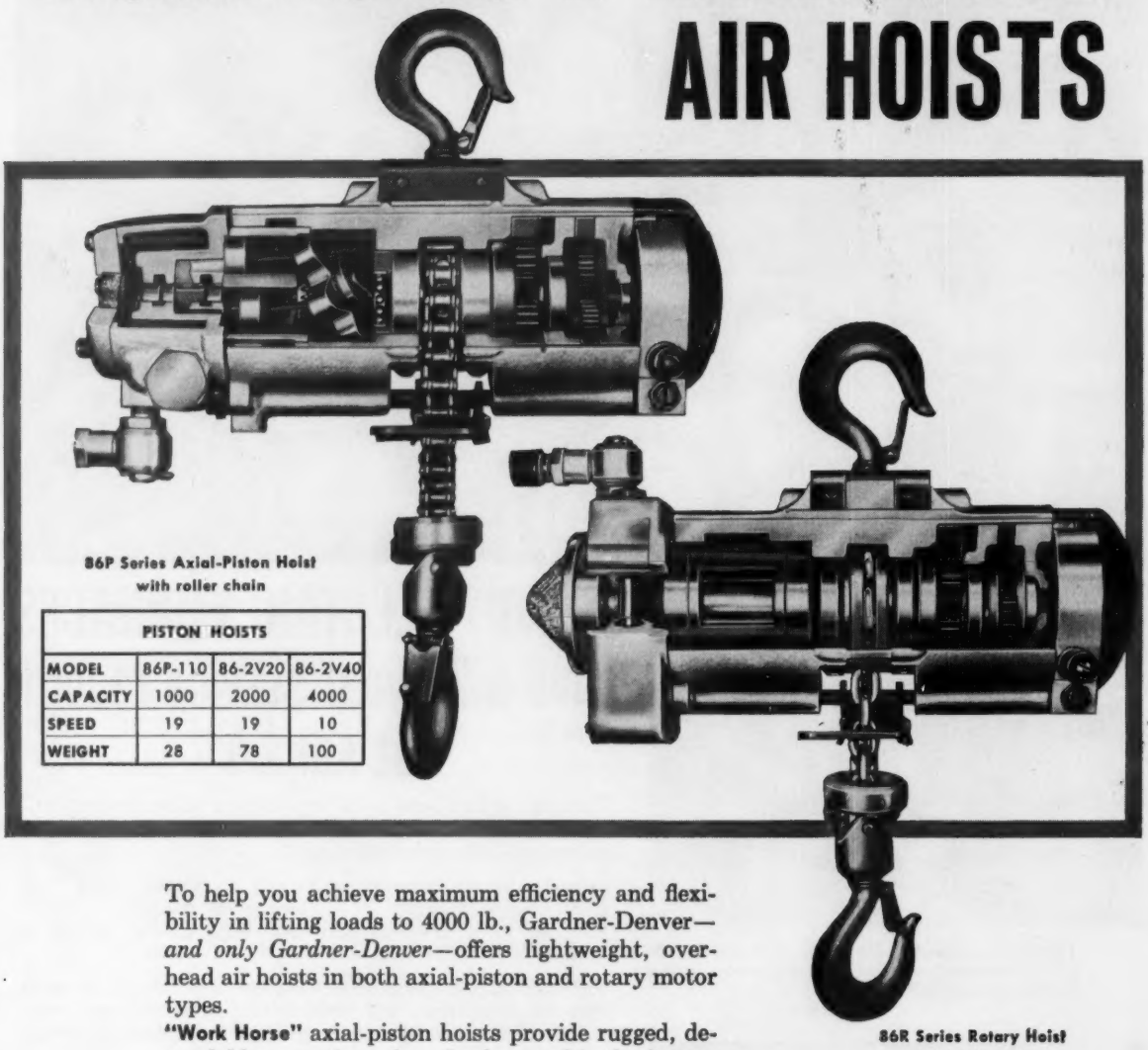
Detroit Electric Furnaces can meet your most exacting requirements—and save you money at the same time!

DETROIT ELECTRIC FURNACE
DIVISION OF
Kuhlman Electric Company
11405 E. State Fair Avenue
Detroit 34, Michigan

For More Information Circle 606, Page 39

to lighten your lifting cost load...

"WORK HORSE" or "RACE HORSE" AIR HOISTS



86P Series Axial-Piston Hoist with roller chain

PISTON HOISTS			
MODEL	86P-110	86-2V20	86-2V40
CAPACITY	1000	2000	4000
SPEED	19	19	10
WEIGHT	28	78	100

86R Series Rotary Hoist with link chain

ROTARY HOISTS			
MODEL	86R-5	86R-10	86R-20
CAPACITY	500	1000	2000
SPEED	90	40	20
WEIGHT	27	27	30

To help you achieve maximum efficiency and flexibility in lifting loads to 4000 lb., Gardner-Denver—*and only Gardner-Denver*—offers lightweight, overhead air hoists in both axial-piston and rotary motor types.

"Work Horse" axial-piston hoists provide rugged, dependable operation where load *control* is the important factor.

"Race Horse" rotary air hoists are designed for use where the combination of speed and ruggedness is the major consideration.

Both types provide variable speed, spark-resistant operation, powerful brake and precise control. Popular models available from 150- to 4000-lb. capacity.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois—Offices in principal U. S., Canadian and Mexican cities
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Ave., Toronto 16, Ontario
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International Offices: Buenos Aires, Argentina; Artarmon, N.S.W. Australia; Brussels, Belgium; Rio de Janeiro, Brazil; Santiago, Chile; Barranquilla, Colombia; Lima, Peru; Ndola, N. Rhodesia; Salisbury, S. Rhodesia; Johannesburg, Transvaal

Now you can melt this

...instead of this

ALUMINUM SCRAP

(Dealers' buying price f.o.b. New York in cents per pound)

Alum. pistons and struts	6½— 7
Aluminum crankcase	8½— 9
1100 (3s) aluminum clippings	11½—12
Old sheet and utensils	8½— 9
Borings and turnings	4½— 5
Industrial castings	9 — 9¼
2020 (24s) clippings	10

ALUMINUM INGOT

(Cents per lb del'd 30,000 lb and over)

95-5 aluminum-silicon alloys	
0.30 copper max.	24.25-24.50
0.60 copper max.	24.00-24.25
Piston alloys (No. 132 type)	26.00-27.00
No. 12 alum. (No. 2 grade)	22.75-23.25
108 alloy	23.25-23.75
195 alloy	25.75-26.75
13 alloy (0.60 copper max.)	24.00-24.25
AXS-679 (1 pct zinc)	23.00-24.00

(Effective Mar. 13, 1961)

The Brown Boveri coreless line-frequency induction furnace obsoletes fuel-fired furnaces for melting aluminum... offers lower overall melting and operating costs, superior metal, cleaner working conditions.

Here in perfected form from the world's most experienced builder of induction heating equipment is a furnace that makes it *practical and profitable* for you to melt light, bulky aluminum scrap which cannot be used in a fuel-fired furnace because of prohibitive metal losses. *Average losses certified by customer for long-term operation of 8 furnaces melting ingot, chips and machining scrap for aluminum auto parts: 3% based on weight of finished castings compared to weight of metal charged to furnaces!* Losses are even lower when melting ingot and heavy scrap – less than 1% as compared to 7% and higher in fuel-fired furnaces.

Other bonus features that are making this furnace the talk of the aluminum casting industry:

- Higher grade, more uniform metal through precise temperature control and natural stirring action. Highest output per unit – up to 19,000 lbs. per hour.
- Fast alloy changes. Furnace can be emptied and restarted with a cold charge. Uses substantially less flux.
- Clean, cool operating conditions. Virtually no fumes.
- You ram the crucible more easily; less curing time.
- Simple, foolproof design—easy to operate and maintain. One man operates several units. Uniquely suited to full automation.
- No clogging or cleaning of channels with this *coreless* design. No danger from metal freeze-ups and no need to hold heat between shifts and over weekends.

Get the whole story. Learn how this furnace can pay for itself while giving you better metal and better castings. Write today to Brown Boveri Corp., Dept. F5, 19 Rector St., New York 6, N. Y.

Above: a 360-KW Brown Boveri furnace for aluminum with melting rate of 1350 lbs./hr. Hydraulic tilting mechanism provides safety and precise control. Brown Boveri makes a full line of line, medium and high frequency induction heating equipment to assure the perfect mating of equipment to every metal and every application.

BROWN BOVERI

For More Information Circle 608, Page 39

IMC A REPORT TO FOUNDRIES FROM TOM BARLOW

how to save sixteen dollars per day...

While working a "Sand School" in Winnipeg recently, a friend told me what was wrong with these little essays. (A friend is one who has guts enough to tell you what you are doing wrong.) He says we sometimes cover too many subjects. So today, we will cover only one — how to make better castings at a lower cost.

Let's start back with a discussion during the IMC Marketing Conference in Milwaukee. One subject was the problem of incurring excessive total cost by virtue of controlling the costs of each individual department at the expense of others. Putting that in English simply says that *sometimes* a dollar spent in the core room may save two dollars in the cleaning room — or somewhere. For instance:

On a recent service job, we found a typical situation in which a wide variety of work was being made in the same sand. Nobody is in favor of this system — but let's face it, man — that's the way foundries are. As a result, this foundry has had to carry a number of facings at a high cost. For very fine detail work (½ pound to 5 pounds), they used Plasti-Bond, Dixie Bond, and a sand with an average fineness of 100 to 115. For the heavy, chunky stuff (300 to 500 pounds), they used open sand with plenty of cereal, etc. to stop scabs. We insisted they could use Plasti-Bond for all of it and save money. So we made the heaviest, most scab-prone casting with the *Plasti-Bond sand designed for the small, fine finish work!* How crazy can you get? An innocent bystander held the bets. The casting was perfect and a repeat performance was equally perfect. As the boss said: "That stuff does a job which anyone in their right mind knows is impossible." So with the proof of the pudding staring us in the face — we figured cost. By cutting the seacoal in half on the entire unit and adding .05% Plasti-Bond to every

batch, we come up with a savings of $16.50 to $19.50 per day. Not bad — considering the sand is more moldable, the castings smoother, and the scrap is reduced.

So — now we have taken care of the wide variety of work and saved $16.00 per day, but can we eliminate the costs of the fine facing for these "cast-to-size" gears, etc.? Here we find the problem that started this whole discussion. The base sand contains 12% to 14% of a 40-screen sand. You just can't make really super-finish with that much 40 mesh — Plasti-Bond notwithstanding. Where does it come from? The core room! So we head for the core room. We find the usual story. The open sand is being used to reduce core-oil costs. The core room man knows he can easily cut the amount of "sharp" sand in half if they will permit him a slightly higher oil budget. No problem here. So now to the boss. Fortunately, this is a man who recognizes the logic of looking at the *total* cost. He immediately sees that it makes sense to *raise* the core room costs a little, if he can save twice as much by getting the facing out of the molding unit. (As an added bonus, his cleaning room costs will also go down because, right now, they spend more time cleaning, grinding, and finishing on the cored surface than they do on the green sand surface.)

So — by raising the core room costs slightly, everybody comes out ahead (including us, of course, since we sell the Plasti-Bond). In the meantime, the foundry saves $16.00 per day — with more savings to come. Once more, we prove that our products and services help you to grow by making your product more salable.*

***"Salable" means a product produced at a reasonable cost with the appearance, utility, and quality to satisfy the needs of the customer.**

EASTERN CLAY PRODUCTS

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

IMC

PRODUCTS FOR GROWTH*
*TRADEMARK

EC-9-01

ADMINISTRATIVE CENTER, OLD ORCHARD ROAD, SKOKIE, ILLINOIS, YORKTOWN 6-3000

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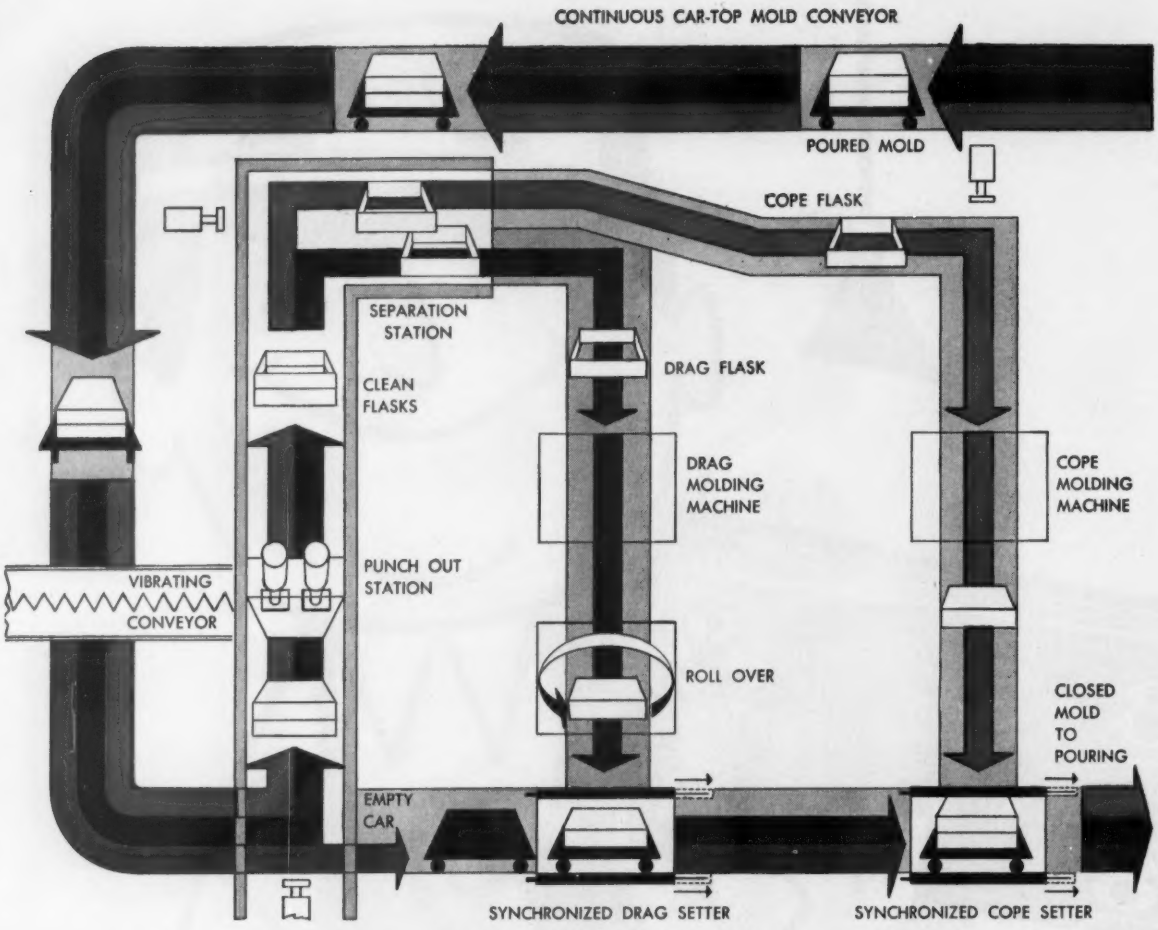


NEW AUTOMATIC MOLD HANDLING SYSTEM

...ANOTHER EXAMPLE OF PLANET VERSATILITY

99

This new Planet automatic mold handling system, installed in a large automotive foundry, is another example of how *Planet Versatility* saves time and money, and increases efficiency and production. The system automatically guides 300 molds per hour through a complete casting cycle . . . *and it will pay for itself in less than one year.*

HERE'S HOW IT WORKS:

After molding, the drag flask (center of diagram) is rolled over 180 degrees and with split-second timing is positioned on a continuously moving car-top mold conveyor. Next, it is conveyed to where the completed cope, without stopping the line, is gently and accurately placed on the drag. The closed mold is then poured, the only manual operation on the line.

The poured mold continues on the car-top mold conveyor to where it is pushed onto the punch out station. Here the castings and sand are dropped onto a double-decked vibrating conveyor for disposition. The clean flasks then move to the separation station, are separated, and returned to their respective molding machines to be refilled and recirculated through the system.

Powered rollers throughout the system hold flask wear and damage to a minimum . . . there is no sliding contact on this Planet engineered system.

Custom designed systems, such as this automatic mold handling system, have helped build Planet Corporation's reputation as a *versatile* organization with solutions to perplexing production, materials handling and automation problems. Let Planet demonstrate how its "PV" engineering skill can help you . . . you'll find that *it pays to plan with Planet.*

PLANET CORPORATION

- Engineered Handling Systems
- Automation Equipment
- Mill & Foundry Handling Equipment

1818 SUNSET AVENUE
LANSING, MICHIGAN

Sales Offices in Principal Cities in the United States and Mexico

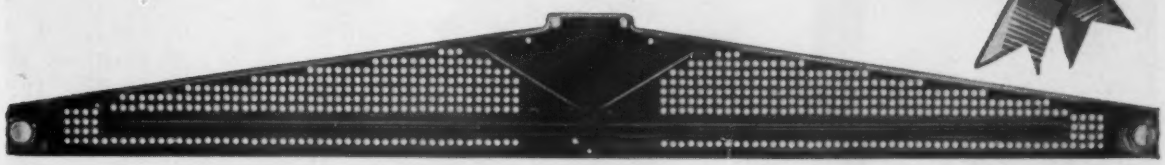
KUX MACHINE CO.

SALUTES

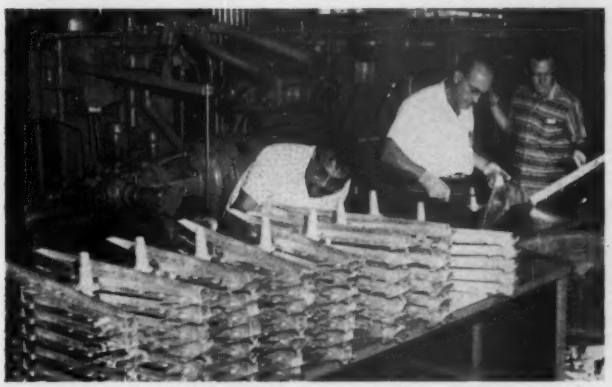
A&A die casting company

. . . top winner of the New Jersey Zinc Co.

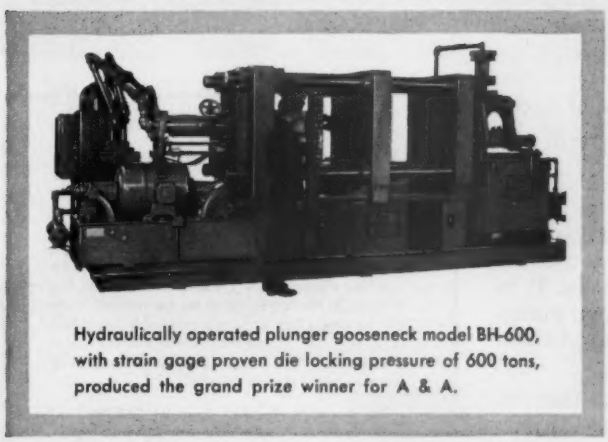
"Zinc Die Casting of the Year" Award



A & A's $1,000-AWARD CASTING—THIS 6-LB. 32-INCH VACUUM CHAMBER FOR AMPEX DIGITAL TAPE HANDLER. CAST AT A SAVING OF 95% OVER PREVIOUS PRODUCTION METHOD.



CONGRATULATIONS TO A & A on their achievement of manufacturing this exceptional wave guide die casting. The casting, having an unprecedented 515 cored holes, was made to the most exacting requirements and tolerances. Two slots running almost the entire 32 inches of casting length are only .007 inches wide, and a flatness within .002 inches end to end is achieved as specified. A perfect cast finish is also a must, as the part is hard chrome plated for wear resistance.



Hydraulically operated plunger gooseneck model BH-600, with strain gage proven die locking pressure of 600 tons, produced the grand prize winner for A & A.

KUX IS PROUD, TOO—TO HAVE HELPED! To solve this and other difficult problems in precision die-casting, Victor Anderson and John Allen, founders of A & A Die Casting Company make almost exclusive use of many different models and sizes of Kux machines with their built-in engineering superiorities.

Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.

KUX MACHINE CO. • 6725 NORTH RIDGE • CHICAGO 26, ILLINOIS

For More Information Circle 611, Page 39

Stub at left shows average waste with conventional cutting carbons; piece at right shows small amount of waste with Kostkutter Rods.

"We save 20 to 25% over conventional cutting carbons with Speer's new KOSTKUTTER RODS*"

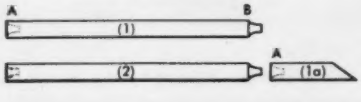
says Benjamin Desper, Cleaning Room Foreman, Atlantic Steel Castings Co., Chester, Pa.

You can save money too! The revolutionary design of Kostkutter Rods, a Speer development, allows the joining of the normally discarded 2½ to 3 inches "waste" to the front of the next rod for further use. Additional savings are realized due to reduced torch damage. It is no longer necessary to economize by burning carbons close to the clamp, bringing the torch too near the hot spot. Additional "left over" carbon is used up with the next rod. This virtually eliminates stub loss. It is important to note that Kostkutter Rods are copper plated (except for the tapered sections) after shaping the rod ends, thereby insuring perfect contact between rods.

Kostkutter Rods are available only from Speer. Buy them in diameters of ½", ⅝", ¾" and 1". Standard cutting carbons are also available at slightly lower prices.

How Kostkutter Rods Save You Money

Each Kostkutter Rod has a tapered hole in one end (A) and a tapered projection at the other end (B) as shown in Diagram 1. The rod is clamped into the torch and used in the normal way. The stub end (Diagram 1a) which, with conventional cutting carbons would be wasted, is removed from the torch and attached to the end of a new Kostkutter Rod (Diagram 2). The tapered end of the new rod slips easily into the tapered hole at the end of the stub and is held firmly by friction. The new rod, with the stub attached, is then clamped into the torch and practically the entire stub is used up instead of being discarded.



SPEER Carbon Co.
Carbon Products Division • St. Marys, Pa.

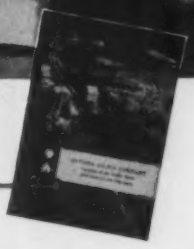
*Patent applied for

OTTAWA Round-Grain SILICA

...BETTER 4 WAYS

- Excellent flowability
- Low bond requirements
- High permeability
- Cleans easily–no breakdown during reclamation

Write today for your free copy of OTTAWA'S new brochure



99.9% pure SILICA

Serviced by truck, barge and two main trunk railway systems, Ottawa Silica offers fast delivery to all corners of the nation.

OTTAWA SILICA COMPANY

OTTAWA, ILLINOIS

SUBSIDIARY PLANTS:

Standard Silica Co. Ottawa, Ill.

Michigan Silica Co. Rockwood, Mich.

For More Information Circle 613, Page 39

easy-to-use, low-cost CORE OILS now are better than ever!

Not every foundry is suited to synthetic core binders. Synthetics are often tricky to use... call for special technical skills... involve costly investment.

You can get *highly accurate* castings simply and easily with WERNER G. SMITH core oils. Many important improvements have gone into W·G·S oils to make them stronger . . . better baking . . . lower in gas content . . . lower priced . . . easier to use . . . more dependable. Our aim is, "The simpler and more efficient — the better!"

Why not investigate W·G·S core oils and find out how they can solve your core problems and lower your costs? Write us about your sand mixes and shop conditions. We'll send you a trial drum — *on approval* — or have our foundry representative call.

You'll find that W·G·S core oils really cost less to use!

WERNER G. SMITH, INC.

1730 TRAIN AVE., CLEVELAND 13, OHIO • PHONE: TOWER 1-3676

Joy-Microdyne scrubber by WP collects sprue crusher and storage bin dust (Marshall, Mich.)

Gray iron foundries in Michigan... and in Southern California...agree:

Dualaire Reverse Jet Filter by WP collects sand mold shake-out dust (Los Angeles, Calif.)

When DUST is your problem— CLEAR IT WITH WP*

For an efficient, economical solution to any dust control problem—look to Western Precipitation. WP is uniquely fitted to handle your unique problem—being the one organization that custom designs, engineers and installs ALL types of dust and fume control equipment: Precipitator, Mechanical, Jet-Cleaned Filter, Hi-Temp Filter, scrubbers and engineered combinations.

With no axes to grind for any one system, WP engineers will give your job a completely unbiased recommendation—whether it's a quote on your specifications, a single component, or a completely engineered installation . . . small, major, simple, or complex.

An inquiry—on your business letterhead—will bring you literature promptly. Just write Western Precipitation, 1000 W. 9th St., Los Angeles 54, Calif. (In Canada, write 8285 Mountain Sights Ave., Montreal, P.Q.)

Dust and fume control since 1907

*WESTERN PRECIPITATION

Los Angeles 54 • New York • Chicago 2 • Pittsburgh 22 • Atlanta 3 • San Francisco 4

Division of Joy Manufacturing Company

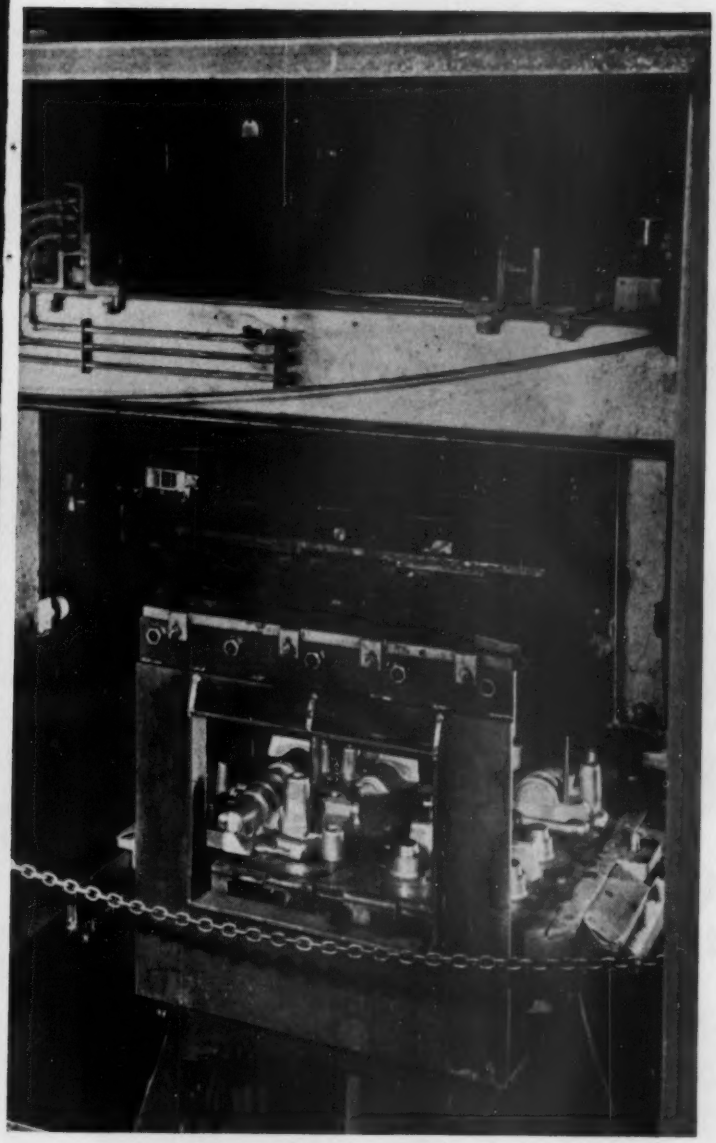
ELECTROSTATIC Precipitators
MULTICLONE Collectors
ESP Combination Units
DUALAIRE Jet-Cleaned Filters
THERM-O-FLEX Hi Temp Filters
TURBULAIRE Scrubbers
JOY-MICRODYNE Scrubbers
also: HOLO-FLITE Processors
HI-TURBIANT Heaters
TURBULEX Calciners

For More Information Circle 615, Page 39

HERMAN Stationmasters Wide-range

"CUTTING COSTS"
BY
HERMAN
NUMBER THREE OF A SERIES

Cut Costs by Simultaneous, Production of Castings



The Herman Two-Station Stationmaster shown herewith, combines the outstanding features of high-speed and flexibility to produce castings ranging in weight from one to thirty pounds.

Costs were cut and production increased by the elimination of two lines composed of 12 squeezers and 5 cope and drag units. The work is now done on one line, using one pair of Stationmaster jolt-squeeze strip cope and drag machines.

In excess of 240 molds per hour are produced, using 40 x 40-inch flasks with an 8-inch drag and 8-inch cope.

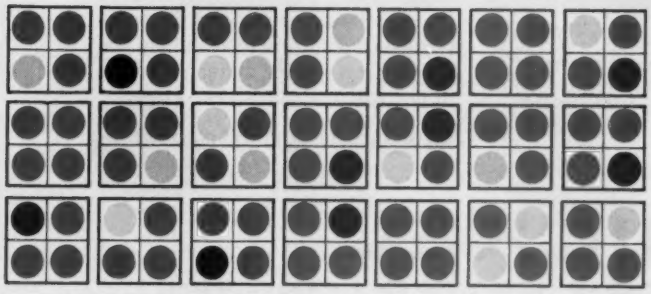
A large number of different combinations of castings can be made in one flask, since four patterns are mounted in 18-inch square quadrants. Any one of these quadrants can be removed and another substituted without disturbing the other three.

Machine operations are performed by completely automatic controls, in this particular installation, but semi-automatic operation is also a feature.

You can cut your costs through the use of an engineered molding machine by Herman. Call one of our nearby Sales Engineers to learn more about the Stationmaster or discover the benefits of other molding machines in the complete Herman line, as they apply to *your* particular casting problem.

Why not do it *today*?

HERMAN PNEUMATIC MACHINE CO.
UNION BANK BUILDING,
PITTSBURGH 22, PA.



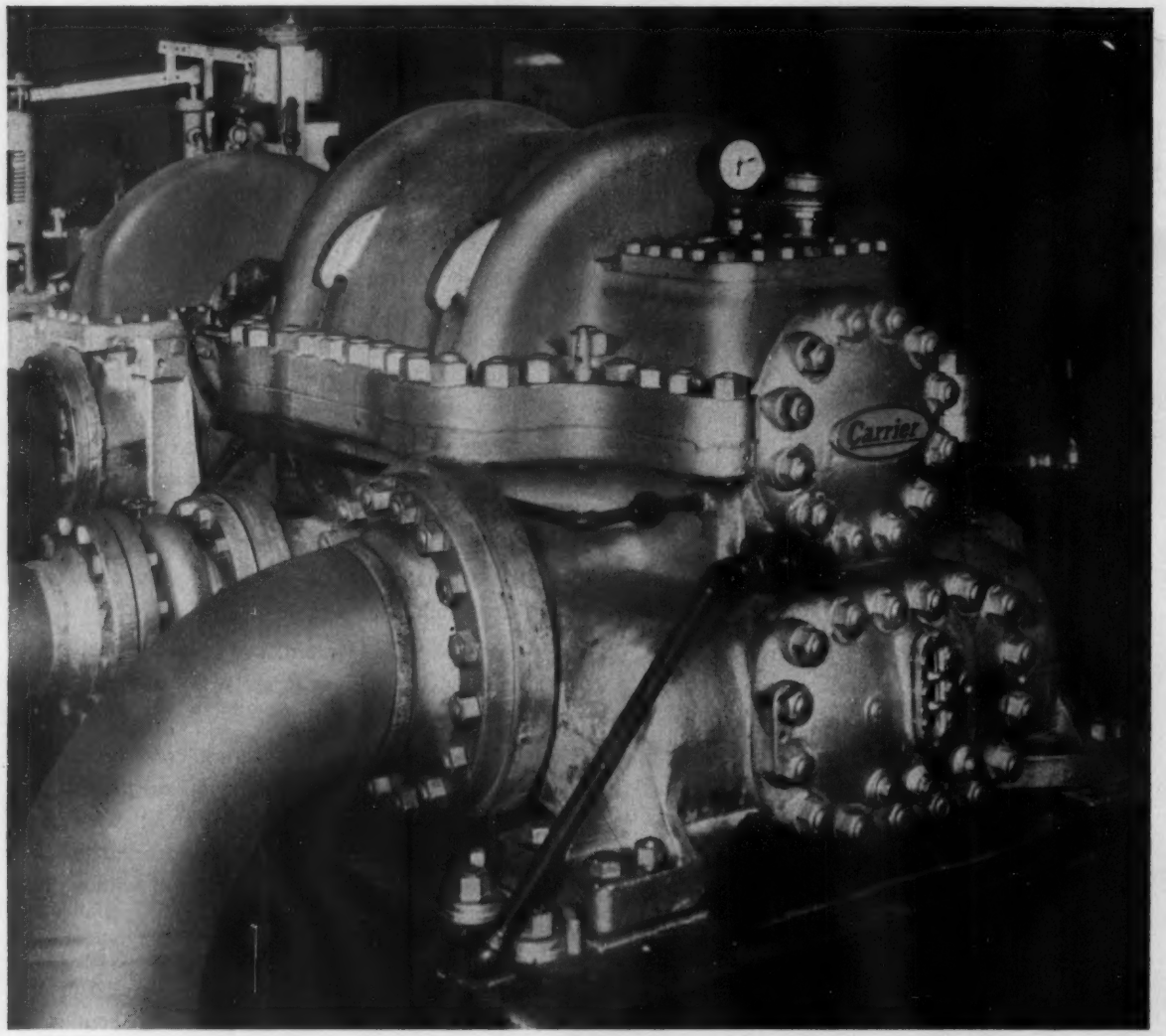
THIS CHART SYMBOLIZES ONE HOUR'S PRODUCTION

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Best Known and Most Progressive Name in Engineered Molding Machines.

3415-HP

For More Information Circle 616, Page 39



4½% Nickel plus good casting makes these casings strong and tough at–185°F

Here's how the foundry solved a low temperature problem:

This Carrier #350 Compressor is designed for producing ethylene by low temperature (–185°F) high pressure (600 psi) fractionation.

Under these conditions ordinary cast steel is brittle and could easily fracture. Could the foundry turn out castings which would have high strength and toughness at the low temperatures involved?

They could . . . this way:

They made these three-ton compressor housing castings from 4½% nickel alloy steel; normalized and water quenched them, and finally tempered them. Under this treatment the castings easily exceed these minimum mechanical properties:

Ultimate tensile strength	70,000 psi
Yield strength	40,000 psi
Elongation in 2"	22%
Reduction of area	30%
Charpy keyhole impact (@ –185°F)	15 ft. lb.

Nickel does wonders for cast irons and steels destined for severe service . . . aids development of desired metal structure.

Recommend Nickel Alloys Freely

Nickel is a plentiful and versatile material and you can count on Inco Nickel's Development and Research Division for information to help you in selecting specific materials to use in particular applications.

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

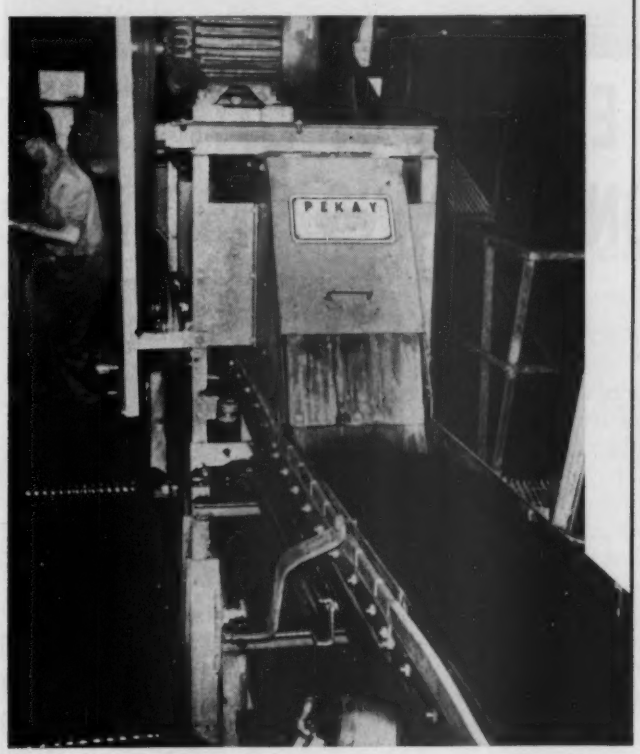
INCO NICKEL

NICKEL ALLOYS PERFORM BETTER LONGER

PAY LESS FOR TRIPLE AERATION THAN FOR ANY OTHER METHOD!

PEKAY AIRATORS

COST LESS TO BUY... TO INSTALL AND OPERATE... TO MAINTAIN



Pekay Airators offer all the advantages of *triple* aeration — including greater capacity and improved sand quality — at a fraction of the cost of conventional aeration equipment.

Exclusive triple-wheel, positive cross blending action of Pekay Airators thoroughly break up wet and dry muller cakes and eliminate the small hard dry lumps of sand persisting through normal mulling cycles. Aeration is so complete that the need for facing sand is often eliminated!

Pekay Airators—*guaranteed to blend and aerate sand to your most exacting requirements*—insure the high permeability and even mold hardness needed to reduce defective castings. You get smoother castings and reduce machining costs and scrap loss.

You also get bonus cooling. Exhausts remove heat by the exclusive Pekay "Air-Through-Sand-Shower" Process.

Pekay Airators fit right on your existing conveyor channels anywhere in your prepared sand distribution system—without costly alterations. Simple installation takes only 25 manhours, doesn't disrupt production.

Pekay Airators—made for any belt width or capacity—can be used in conjunction with your existing sand equipment or can be incorporated with Pekay Coolerators and Mixer-Mullers into a *continuous* sand conditioning facility. Either way, Pekay Airators combine the economy you want with the operational efficiency you need to produce castings of uniformly high quality.

Fill in and mail the coupon for full information, or contact Pekay direct.

PEKAY
MACHINE & ENGINEERING CO., INC.

2520 W. Lake Street, Chicago 12, Illinois

Pioneers and developers of continuous sand conditioning equipment for foundries. Used internationally.

I would like information on:

☐ Pekay Airators ☐ Pekay Coolerators
☐ Pekay Mixer Mullers ☐ Pekay M-T-Matic Buckets

Name_____

Company_____

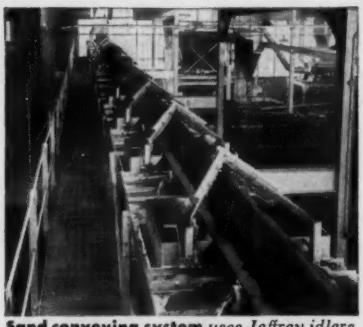
Address_____ City and State_____

INCREASE FOUNDRY EFFICIENCY WITH SAND HANDLING AND CONDITIONING SYSTEMS

Jeffrey's experience in mechanizing foundry operations covers *your* specific operating conditions.

For example, in handling and conditioning sand, a complete system for handling sand from the molders' stations through pouring, shakeout, conditioning and back to the molders can pay off for the large-run foundry in a short time. Other foundries find a semi-continuous system, with its greater flexibility, more efficient. End result—greater efficiency, stepped up output in existing floor space.

Jeffrey starts with your basic requirements—engineers the right conveying and processing equipment, erects the equipment if desired. Consult Jeffrey for cost-cutting throughout your operations...Sand Handling and Conditioning Systems, Mold Preparation and Handling Equipment, Castings Handling Equipment, Special Unit Machines. For illustrated Catalog 911 write, The Jeffrey Manufacturing Company, 907 North Fourth St., Columbus 16, Ohio.



Sand conveying system *uses Jeffrey idlers for minimum-maintenance service.*

Time is saved *by delivering sand directly to molders' stations.*

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY... CONTRACT MANUFACTURING

JEFFREY

CAST FOR THE RESEARCH NEEDS OF THE FOUNDRY INDUSTRY

The Magcobar Research and Development Center at Arlington Heights, Illinois, helps the Foundry Industry produce better castings at lower costs through research.

With the Center's pilot foundry, Magcobar sand engineers are able to duplicate the entire castings operation and study sand properties, bonding materials, and mixing techniques. From such research comes valuable information to help foundries improve castings.

Research findings are used by Magcobar to develop new foundry products and to perfect the utilization of its foundry bentonites, Yellowstone®, Auto-Bond®, and Southern Star®.

The Research and Development Center is the first such facility to be owned and operated by a foundry supplier. If your concern is better castings, it will pay you to investigate Magcobar service. Write for free booklet, "Progress is the Fruit of Research."

For information about Yellowstone, Auto-Bond, and Southern Star, see your local Magcobar dealer.

MAGNET COVE BARIUM CORPORATION
P. O. Box 355
Arlington Heights, Illinois

Magcobar®
FOUNDRY PRODUCTS

For More Information Circle 619, Page 39

Your real 'best buy' is the one that fits! *Vancoram Silicon Alloys*

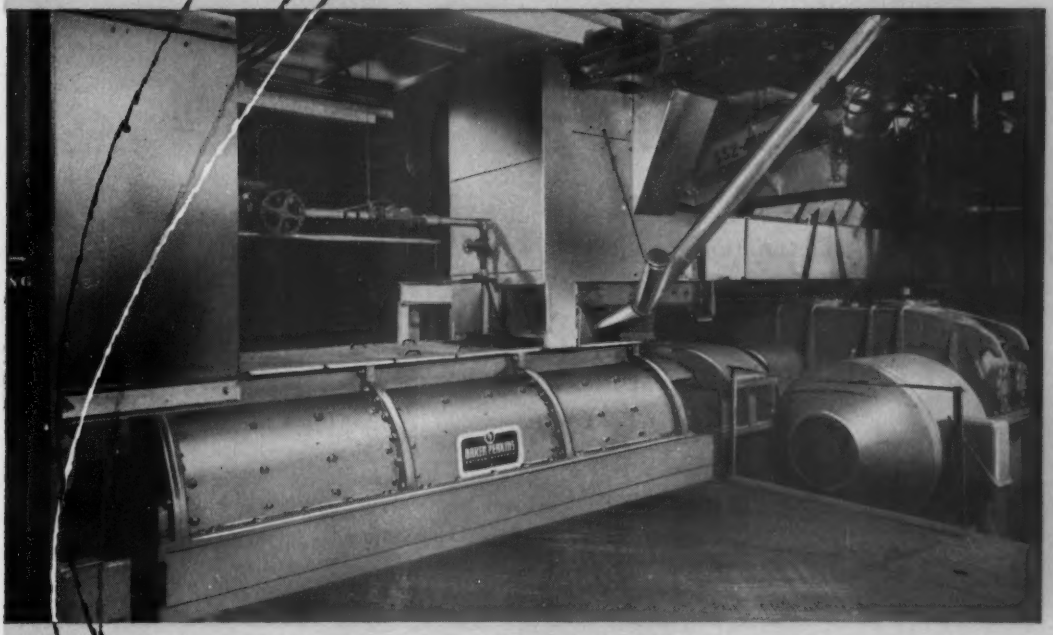
If the Silicon product you use isn't *exactly* fitted to your needs, it is *not* your best buy, no matter how much of a bargain it seems. And because Silicon has so many different applications in the making of steel, it is not always easy to be sure that a particular grade is the one that will make for the lowest final costs.

This is just where your VCA representative can be of most help to you. From the comprehensive range of Vancoram Silicon products, he is able to recommend and supply the one most suited to your needs. Use clean and uniform Vancoram Silicon products with confidence—they're 'job-balanced' for economy and quality controlled all the way! Vanadium Corporation of America, 420 Lexington Avenue, New York 17, N.Y.
Chicago • Cleveland • Detroit • Pittsburgh

VANADIUM
CORPORATION OF AMERICA
Producers of alloys, metals and chemicals

VANCORAM

NOW . . .
a single B-P Continuous Muller handles 300 tons of sand per hour



The new Baker Perkins Size 8 Muller, now in successful operation in one of the midwest's automotive foundries, has 300% more hourly capacity than any available batch type muller and 100% more capacity than the next size B-P continuous unit. As with all B-P Continuous Mullers, cleaner, smoother castings are obtained with fewer rejects because molding sands are thoroughly mixed and tempered. The special Sigma-type agitators assure that each grain of sand is coated with the correct proportion of bond.

Baker Perkins builds Continuous Mullers in capacities from 30 to 300 tons per hour. Because of their rigid, rugged construction, B-P Continuous Mullers give many years of service. Installations in many of America's largest foundries have proven the efficiency of Baker Perkins Continuous Mullers under the most exacting conditions.

For further information about B-P Continuous Foundry Sand Mullers and B-P Unidor mixers for core and special process sand mixing, send for catalog No. F-156.

371

BAKER PERKINS INC.

FOUNDRY MACHINERY DIVISION • SAGINAW, MICHIGAN

For More Information Circle 621, Page 39

... familiar combination
for the finest in
FOUNDRY COKE

Foundrymen throughout the nation know this familiar ABC combination for low cost operation, reliability and service.

Compare ABC's important advantages for the *finest* in foundry coke:

- ✓ **SUPERIOR CHEMICAL AND PHYSICAL PROPERTIES**
- ✓ **EXACT SCREENING TO A CHOICE OF SIZES**
- ✓ **CUPOLA-TESTED CARBON CONTROL**
- ✓ **PRACTICAL TECHNICAL ASSISTANCE ON MELTING PROBLEMS**
- ✓ **YEARS OF SUCCESSFUL SPECIALIZED EXPERIENCE**
- ✓ **MODERN FACILITIES — FULLY MAINTAINED**
- ✓ **DEPENDABLE 7 DAY/WEEK SHIPPING SERVICE**

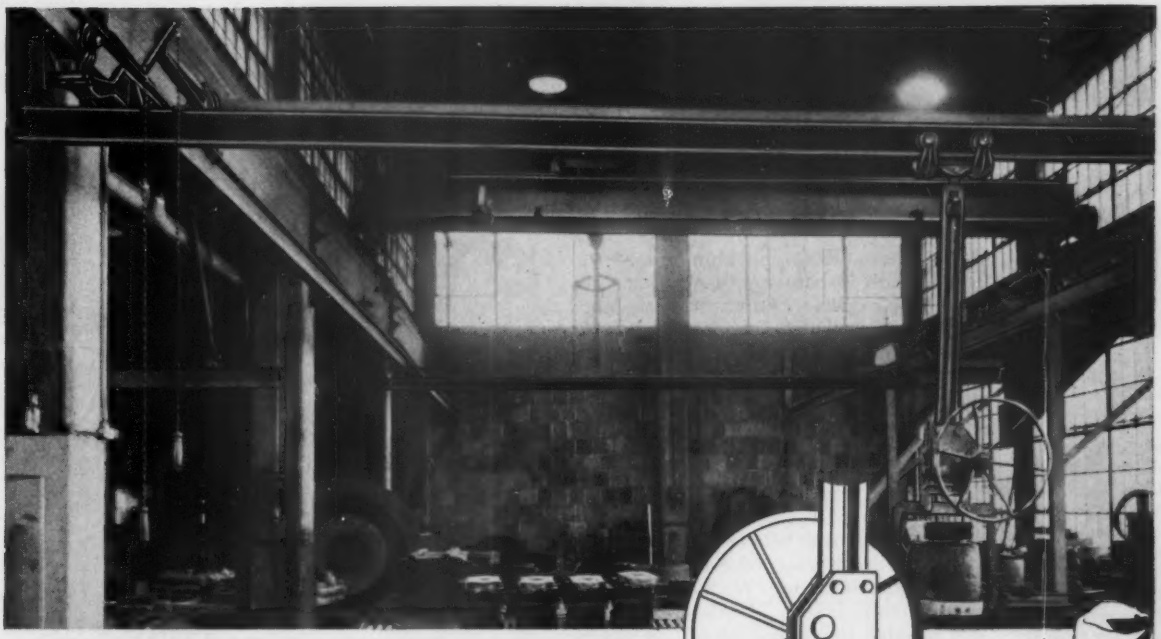
An exclusive with ABC . . .

You can choose from five types of ABC Foundry Coke, each designed for carbon pickup within closely controlled limits. ABC Service Engineers will gladly help you select the type best for your particular melting operation.

ALABAMA BY-PRODUCTS CORPORATION

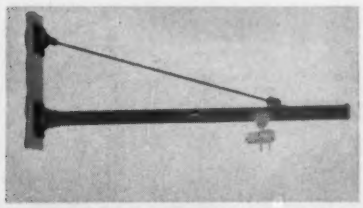
General Sales Office:
First National Building
Birmingham, Alabama

SALES AGENTS: Great Lakes Foundry Sand Company, Detroit; St. Louis Coke & Foundry Supply Co., St. Louis; The Ranson and Orr Company, Cincinnati; Kerchner, Marshall and Company, Pittsburgh; Anselman Foundry Services, St. Charles, Illinois.

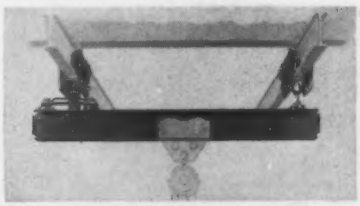


Reduce handling costs with . . . R-W CRANE and "TRU-TRED" MONORAIL SYSTEMS

Modern foundries have found that they can now efficiently and safely cut costs, and speed-up production by installing R-W Cranes and Monorail Conveyor systems. Whether you need a single unit for a specific operation or a complete system, R-W Cranes and Monorail Conveyors combine ladle handling with maximum smoothness and safety, plus 100% utilization of pouring floor area. Transfer crane with safety interlocks at transfer points provide flexibility and easy handling throughout pouring operations. R-W Cranes and Monorail systems are available in a size to efficiently and economically meet your specific requirements.



R-W 939 Swinging Jib Crane . . . available in a wide variety of sizes and capacities up to 4000 lbs. . . . Furnished with rod support. R-W 968 Jib Crane has curved track to support the outer end of boom.



R-W 971 Flexible Traveling Crane . . . self adjusting yoke and cross head . . . will not bind as bridge need not maintain right angles to tracks. Available in variety of sizes and capacities up to 8000 lbs. Not applicable as a transfer crane.

Why not let an R-W Sales-Engineer show you, without cost or obligation, how R-W equipment can effect remarkable savings for you in time, money and maintenance. Write today for complete information.

Richards-Wilcox
MANUFACTURING COMPANY
"MATERIAL HANDLING DIVISION"

466 W. THIRD STREET, AURORA, ILLINOIS • Branches in Principal Cities

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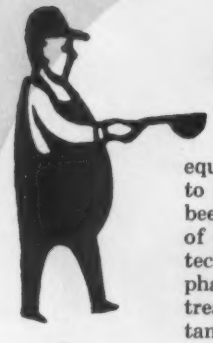
Wherever aluminum needs heat



Meet "Little Joe"! He looks something like a fellow in our plant but we really use him as a symbol of the good right hand of service Lindberg-Fisher's expert design staff and our complete line of "heat for aluminum" equipment is able to render you.

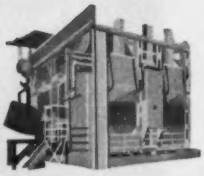
LINDBERG FISHER

You'll find this nameplate on all the equipment you'll need for applying heat to aluminum. Heat and aluminum have been Lindberg's babies for years. Our staff of expert engineers, metallurgists and technicians is widely experienced in all phases of aluminum melting, casting, and treating and has pioneered many important developments in aluminum processing by heat. Today, Lindberg offers you a complete line of heating equipment for every requirement in this field. This includes every needed type of melting, holding or heat treating furnace, large and small, shop built or field erected, fuel fired or electric (resistance, 60 cycle induction, arc or high frequency). We hope you'll let our symbolic friend, "Little Joe", guide you through the exposition of this equipment offered on these pages.

Hot Metal Delivery

MELTING

"RIGHT FROM THE START, LINDBERG EQUIPMENT TAKES OVER YOUR ALUMINUM HEATING NEEDS."

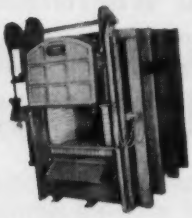


Fuel fired reverberatory. Charging well optional.

"MOLTEN METAL FROM REDUCTION CELLS IS HELD, OR INGOTS MELTED, IN FURNACES LIKE THESE."

CASTING STATION

"MOLTEN METAL IS HELD AT THE CORRECT TEMPERATURE UNTIL PROCESSED INTO CASTINGS."



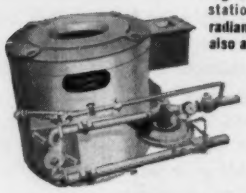
Fuel fired reverberatory, holding or melting.

"MANY CASTING STATION FURNACES CAN BE EQUIPPED WITH THE LINDBERG AUTOLADLE, NAMED 'LITTLE JOE', AFTER ME."

Autoladle for automatic ladling, four shot sizes available, up to 100 lbs.

HYNi nitrogen generator, for atmosphere melting and fluxing.

Fuel fired crucible or pot, holding or melting, stationary. **New radiant wall type also available.**



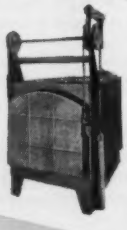
SPECIAL EQUIPMENT

"SOME CASTINGS MAY REQUIRE HEAT TREATMENT AND THESE ARE HANDLED IN THE FURNACES BELOW."

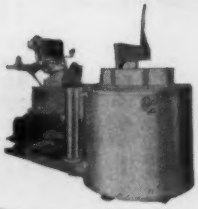
Gas fired billet heater for extrusions.

"SO, DOWN TO THE FINISHED PRODUCT, LINDBERG EQUIPMENT TAKES CARE OF EVERY STEP."

HEAT



Cyclone heat treating, electric or fuel fired, box or pit.



Cyclone heat treating, electric or fuel fired, box or pit.

60 cycle induction billet heater for extrusions.

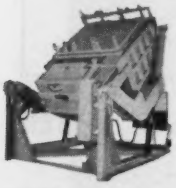
BILLETS RODS CASTINGS

LINDBERG equipment will apply it

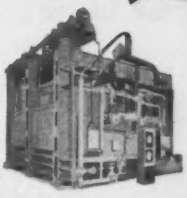
Key
Molten Metal
Solid Metal

Ingot

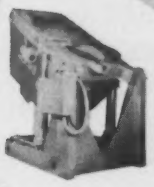
AND HOLDING FURNACES



60 cycle two chamber induction, tilting.



Fuel fired double reverberatory. Especially suitable for alloying. Charging well optional.



60 cycle, two chamber induction, tilting; melting and holding.

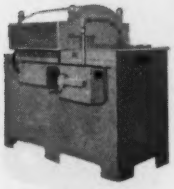
MELTING, HOLDING AND REMELT FURNACES

AS REQUIRED, MOLTEN METAL IS TRANSFERRED TO FURNACES AT THE CASTING STATIONS."

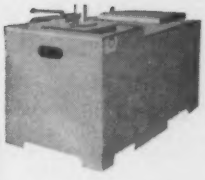
"INGOTS CAN ALSO BE MELTED AND HELD IN THESE FURNACES."

FURNACES

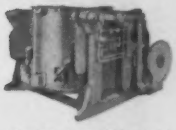
60 cycle induction coreless, tilting, ideal for melting chips.



Electric resistance, "radiant dome," reverberatory, holding.



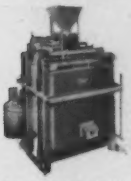
60 cycle, two chamber induction, holding or melting, stationary.



Fuel fired, crucible or pot, tilting, melting.

Electric resistance, crucible or pot, holding or melting, stationary.

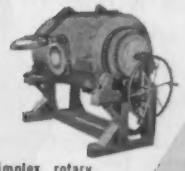
Fuel fired, Dry-Hearth, two chamber, holding or melting.



Electric resistance, "radiant muffle," Dry-Hearth, melting and holding, nitrogen atmosphere.

High frequency induction, tilting, melting.

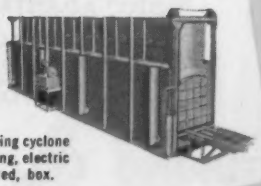
"GATES, RISERS, SCRAP CASTINGS, ETC. GO BACK TO THE FURNACES AT THE RIGHT FOR REMELTING."



Fuel fired, Simplex, rotary, horizontal drum, melting.

"WHY NOT GET IN TOUCH WITH LINDBERG FOR YOUR ALUMINUM HEATING NEEDS? TELL THEM 'LITTLE JOE' SENT YOU."

TREATING FURNACES



Homogenizing cyclone heat treating, electric or fuel fired, box.

D.C. INGOTS

For More Information Circle 624, Page 39

We'll be glad to discuss your aluminum processing needs with you. Get in touch with your local Lindberg Representative (see your classified phone book) or write us direct.

LINDBERG FISHER DIVISION

LINDBERG ENGINEERING COMPANY

2450 West Hubbard Street, Chicago 12, Illinois

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland, and West Germany.

YOU'LL DO A BETTER JOB

with **H. V. ADAMS DESIGNED**

HIGH EFFICIENCY FOUNDRY TOOLS

"UNIVERSAL FREE WHEELING"

FOUNDRY SAND RIDDLE

with the Double Eight Vibration

Because of its convenient size, light weight and good riddling capacity it long has been a favorite in the foundry. It also can be used for mixing core sand or for sifting sand directly into molds.

The mechanism is entirely enclosed protecting it from harmful dust and grit.

The main frame is cast in very strong tough aluminum.

It uses quick change ferruled sieves with 20 in. diameter sifting area. There are no loose wires to harm hands.

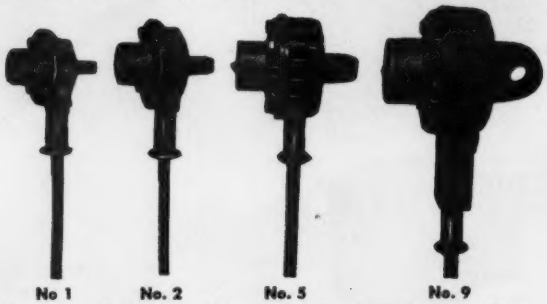
THE "ROTOPLANE" SPEED SIFTER

WILL GIVE YOU

• SPEED • ECONOMY • SAFETY • LONGER LIFE • GREATER SIFTING CAPACITY

Its sturdy one-piece frame and long shaft add to vibration effectiveness. The sealed-in mechanism assures protection of motor and bearings from exposure to dust and grit. This sealed in protection and "Rotoplane's" free-rotary action vastly increase bearing life. No exposed moving parts endanger the operator. Sieves have 20 inches diameter clear sifting area—are mounted in a smooth steel ferrule with no jagged edges to cause dangerous cuts and scratches.

"RED (Devil) ELECTRIC" VIBRATORS



No 1 No. 2 No. 5 No. 9

These hard hitting Adams designed Vibrators have served the foundries for over 30 years. They are provided with a 6 foot 3 wire authorized cable and 3 wire grounded connector which, when connected with our 3 wire grounded Red Electric Knee Switch, automatically grounds the vibrator protecting the worker from shock. The vibrators have passed the U. S. Government code inspection.

Other Foundry Products:

- **No. 11 NOISELESS TYPE VIBRATOR**
- **A-20 ELECTRIC VIBRATOR**
- **RED ELECTRIC KNEE SWITCHES**
- **"ROTO" ADJUSTABLE BIN VIBRATOR**
- **2 MIN. UNIVERSAL FINENESS TEST SIFTER.**
- **UNIVERSAL TRIPOD CARRIER**

ORDER ALL SIFTERS AND VIBRATORS WITH GROUND WIRE!!

FOUNDRY SUPPLIES MANUFACTURING CO., NOT INC.

2221 Orchard Street - Chicago 14, Illinois

For More Information Circle 625, Page 39

Circle 642 on Page 39→

HOW TO HOLD A CUP OF HELLFIRE

Gently, friend. We're pouring a cup of molten iron from a man-made volcano. No slips twixt cup and lip, please. And now the pouring ladle must be moved to the mold and its contents emptied. A touchy problem in material handling? Yes, a delicate problem. Yet this is the daily activity of foundries and mills throughout America—the daily work of Whiting cranes and materials handling systems.

If you have to move materials—in shop or mill, dock or warehouse—move it at low cost, dependably and safely, call on Whiting. There are specialists here who can talk your language.

The facts on "How to Select an Overhead Traveling Crane" are yours for the asking. Ask for Bulletin 79. Write *Whiting Corporation, 15607 Lathrop Ave., Harvey, Illinois.* In Canada: *Whiting Corporation (Canada) Ltd., 350 Alexander Street, Welland, Ontario, Canada.*

See our catalog in Sweets

90 OF AMERICA'S "FIRST HUNDRED" CORPORATIONS ARE WHITING CUSTOMERS

CRANES

WHITING

MANUFACTURERS OF CRANES; TRAMBEAM® HANDLING SYSTEMS; PRESSUREGRIP; TRACKMOBILES®; FOUNDRY, RAILROAD, AND SWENSON CHEMICAL PROCESSING EQUIPMENT

the standard of excellence everywhere

the fleur de lis — AC your guarantee of quality. Quality AC alloys insure the utmost in uniform chemical composition and physical characteristics. In fact, we're so proud of our product – we ship it to you packaged in polyethylene. ■ AC maintains a complete warehouse inventory located in the heart of industrial America – to provide immediate dependable delivery when you want it – where you need it. ■ These are just a few of the reasons why Alloys and Chemicals Corporation is the fastest growing aluminum smelter in the country.

Our sales engineers and technical staff are available for consultation.

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Aluminum Alloys

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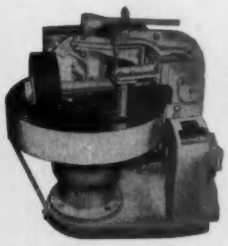
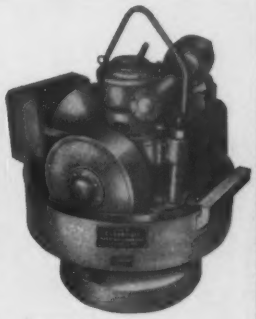
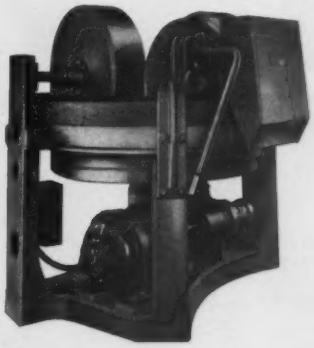
For More Information Circle 643, Page 39



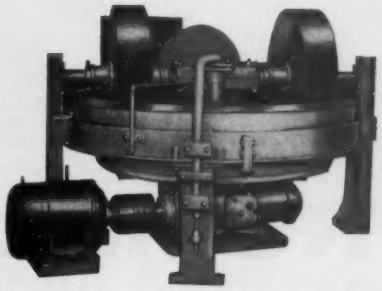
No. 251 2½-ft. diameter
. . . . ½ to 1 cu. ft. batch



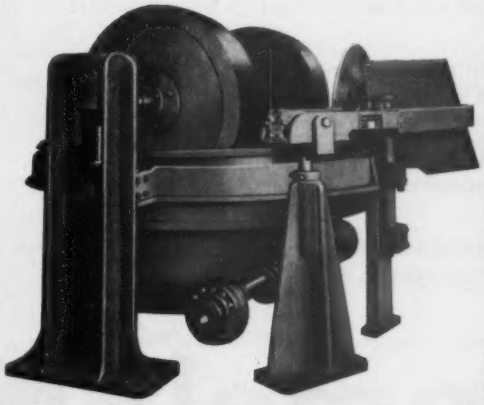
No. 414 4-ft. diameter
. . . . . 2 to 4 cu. ft. batch



No. 610 6-ft. diameter. . . . 10 to 14 cu. ft. batch



No. 715 7-ft. diameter. . . . 15 to 20 cu. ft. batch



No. 930 9-ft. diameter. . . . 30 to 40 cu. ft. batch

ANY SIZE MADE TO YOUR SPECIFICATIONS

From compact portables to heavy-duty mullers

CLEARFIELD

CAN SUPPLY THE RIGHT MIXER FOR YOUR JOB

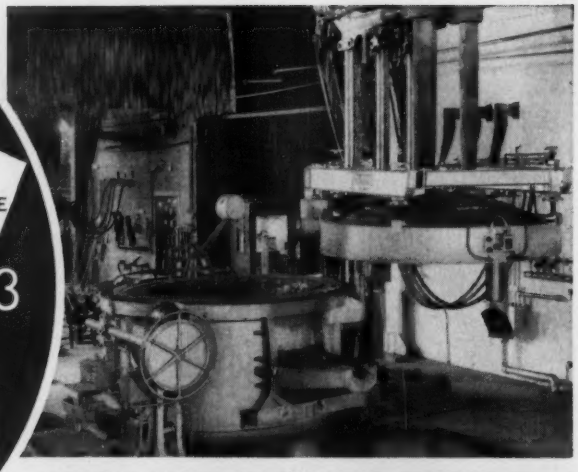
Clearfield Mixers are available in capacities ranging from ½ to 40 cu. ft. . . . for batch or continuous mixing. They're constructed of rugged cast iron for strength, rigidity and wear resistance. And all Clearfield mixers feature the "revolving pan" mixing principle which keeps the material in *constant* state of violent motion; this eliminates the "lag" intervals which result in mixers with mullers and scrapers that revolve instead of the pan. With Clearfield revolving-pan mixers you get a constant controlled-course mixing action which assures a better balance of blending and tempering.

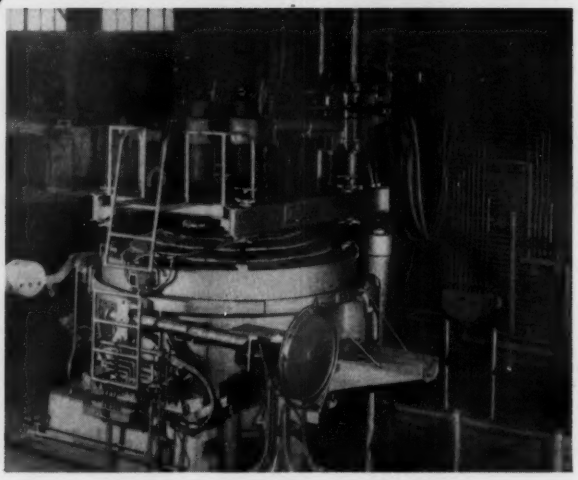
Whether you need a mixer for maintaining proper bond and moisture in heap sands . . . preparing facing sand or core sand for castings . . . or for any foundry application where sand control is important . . . Clearfield Mixers can do the job better, and save you production money.

Let us help you determine the best type and size for your particular needs. No obligation. Meanwhile, send for Catalog No. 90.

CLEARFIELD
MACHINE COMPANY
CLEARFIELD, PENNSYLVANIA, U.S.A.

For More Information Circle 626, Page 39





When you melt... LECTROMELT*

TOP CHARGING provides smooth, fast turn-around in furnace operation—less downtime between heats and less heat loss. Linings and electrodes last longer.

HIGH POWER INPUT allows rapid metal melting. Lectromelt makes this possible with large transformers and leads, more efficient cooling and heavier furnace construction.

RAPID TILTING is accomplished smoothly and safely. Mechanism is accurate, strong and side-mounted—located out from under, where it won't get clogged by spillage.

Catalog 10 describes Lectromelt Furnaces. For a copy, write Lectromelt Furnace Division, McGraw-Edison Company, 314 32nd Street, Pittsburgh 30, Pennsylvania.

*Reg. Trademark U.S. Pat. Off.

McGRAW EDISON

Lectromelt

CANADA: Wild-Barfield Electric Furnaces, Ltd., Toronto...ITALY: Forni Stein, Genova...ENGLAND: G.W.B. Furnaces Limited, Dudley, Worcs....SPAIN: General Electrica Espanola, Bilboa... FRANCE: Stein et Roubaix, Paris...BELGIUM: S. A. Stein & Roubaix, Bressoux-Liege... JAPAN: Daido Steel Co., Ltd., Nagoya

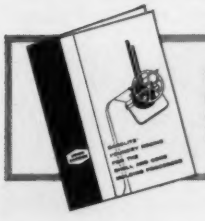
NEW ECONOMY IN SHELL MOLDING...

flake-form resins for hot-coated sand

In their new flake form, BAKELITE Brand foundry resins bring you three-fold benefits in hot-coating sand for use in making shell molds and cores.

Flake-form resins result in greater mold and core strength with a minimum resin content—as little as 3%. Coating cycles can be effectively reduced. The hazard of dust is virtually eliminated.

Choose from five BAKELITE® Hot-Coating Resins. All of them are available in the new flake form, the widest variety available from a single supplier, giving you an ample choice of formulations in selecting the one that fits your foundry needs. In addition, Union Carbide Plastics has a complete line of foundry resins for all your shell molding requirements . . . dry-mix, cold coating, and warm coating sand.



This free, illustrated booklet describes the various BAKELITE Brand resins for shell molding and can serve as a handy guide in finding the right material. Write Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. *In Canada*: Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE

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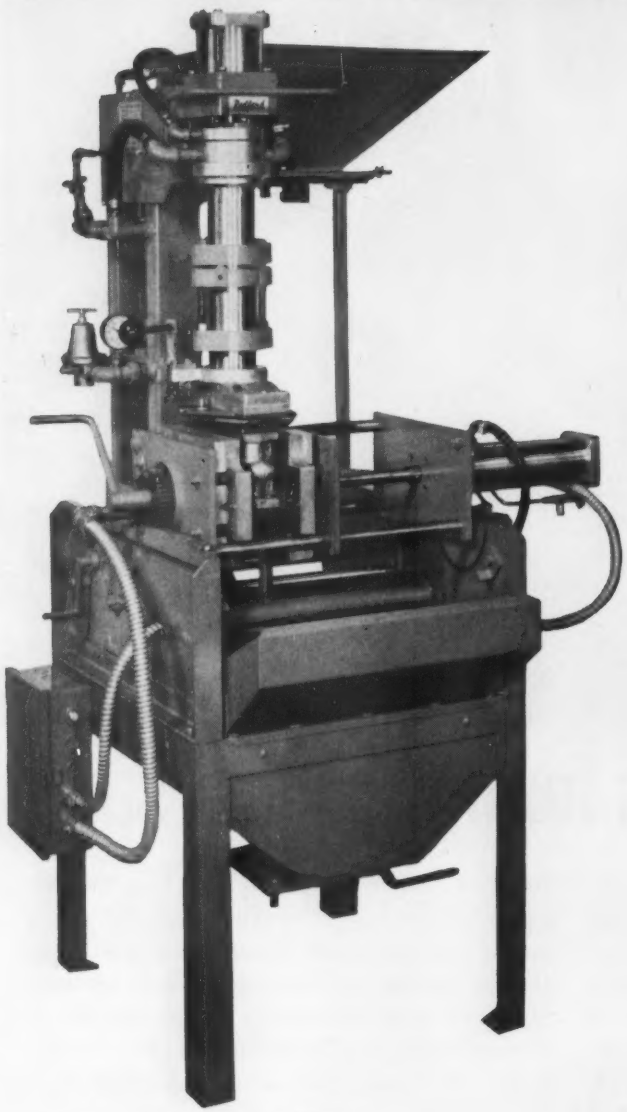
Redford

MODEL HP-4 SHELL CORE BLOWER



A very fast low cost machine that is setting new standards in the production of small shell cores. The quality of intricate shell cores is improved because sand is blown into core box cavities through unrestricted blow holes. A novel cradle-type core box clamp is used to invert the core box and at the same time bring the core box within easy reach of the operator for core removal. There is no out of balance weight to struggle with. The machine can handle core boxes up to 10″ x 10″ in size. Shell cores may weigh up to 4 lbs., before draining.

The HP-4 Redford has ample blow capacity and can also be used to blow Furfural resin sand mixes into heated core boxes.

Price F.O.B. Detroit—$1,200.00
For complete information write for Bulletin HP-4

. . Above cores illustrate the variety of work that can be done with the Redford HP-4 Core Blower.

REDFORD IRON & EQUIPMENT CO.
20733 Glendale - Detroit 23, Mich.
Phone: KEnwood 1-8611

I'm *Soffel's* Red Devil Thermotomic HoTop

I'll pump all the metal you can pour... 24 hours a day... the hotter—the better!

A demonstration will show you how effectively you can cut costs & increase yields

Reduce the size of your heads and let Soffel's Red Devil Thermotomic Hotop keep that reduced amount of metal in the heads liquid so you will gain *more* sound, shrink-free castings from every ladle of metal poured.

Soffel's Red Devil Thermotomic Hotop will *not* contaminate any non-ferrous alloy, is *not* premium priced, requires *no* special engineering personnel, definitely *will* reduce costs and increase yield. Ask for demonstration today.

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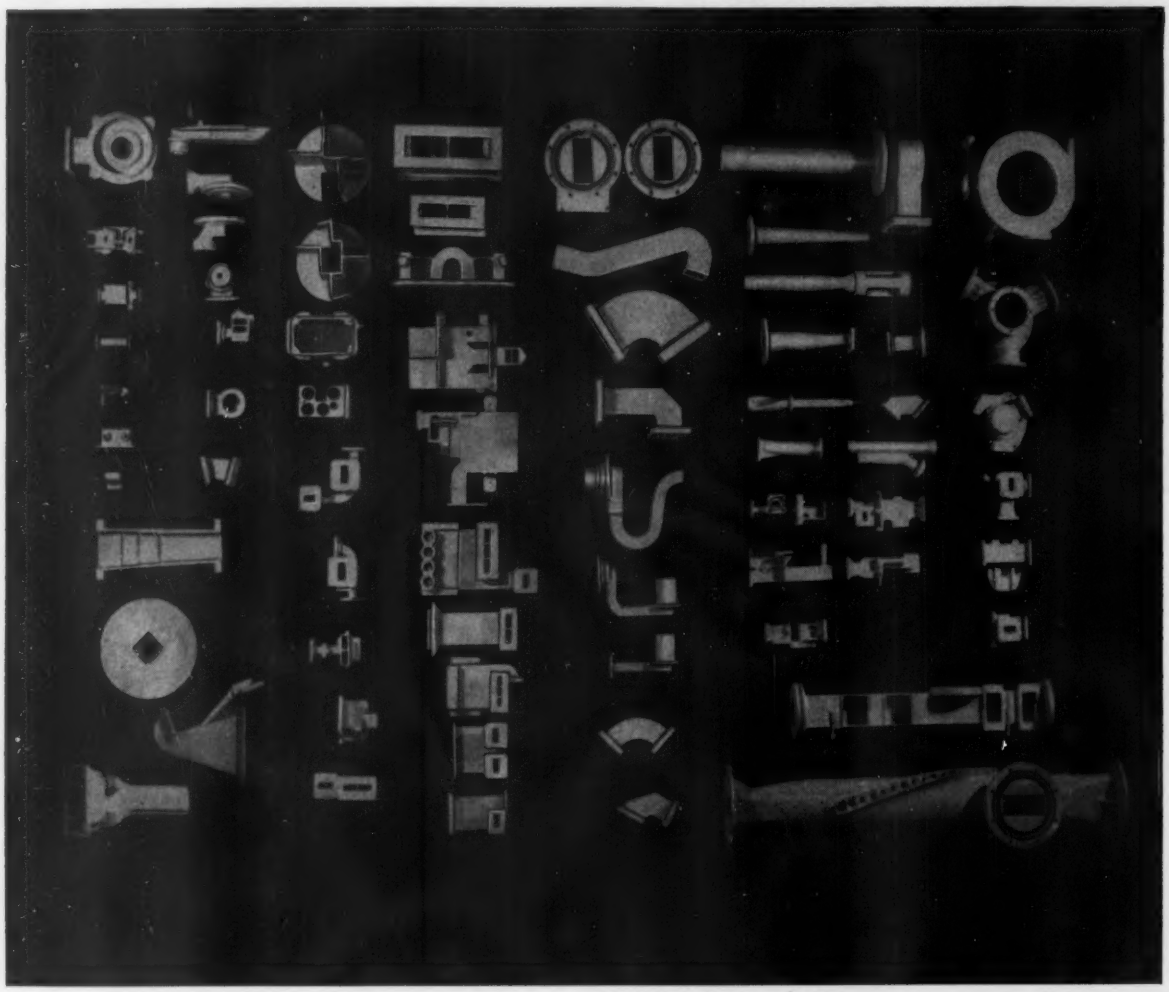
PITTSBURGH METALS PURIFYING CO., INC.
Phone: NAtional 5-1571 • Mars, Penna.

"WORLD'S LEADING MANUFACTURER OF FLUXES, PURIFIERS AND EXOTHERMIC COMPOUNDS FOR ALL METALS AND ALLOYS"

AFS MEMBERS...Welcome to San Francisco. For castings like these use the new Bestwall #1 Metal Casting Plaster



These castings—photographed at the Sims Casting Corp., Syracuse, N.Y.—are typical of those made with the new Bestwall #1 Metal Casting Plaster. If you are not already using this plaster for non-ferrous precision castings you should be. A few words will tell you why: *First,* with Bestwall #1 Metal Casting Plaster you can cast to a tolerance of .0025 inches per inch. *Second,* you can produce aluminum castings with a measured surface finish of .50 micro-inches. *Third,* it gives you the widest process size range of any precision casting material—from under 6" to over 36". It is the finest metal casting plaster ever developed. Prove this in your own plant! Bestwall Gypsum Co., Ardmore/Pa.

INDUSTRIAL BESTWALL GYPSUM PRODUCTS

Plants and Offices throughout the United States

POSITIVE DUPLICATION – EVERY TIME!

You can depend on a rubber stamp to print identical information time after time after time. You can also depend on the Positive Duplication of these portable Ⓟ*Wheels . . . and *all* CINCINNATI Ⓟ GRINDING WHEELS.

HERE'S HOW (PD) IS ACHIEVED

To supply you with wheels of uniform excellence, Cincinnati's unique Ⓟ manufacturing process is unvaryingly regulated by 36 separate quality controls . . . For example humidity and temperature of the Wheel Mold Room are kept at the same levels every hour of every day throughout the year—an essential safeguard of Ⓟ uniformity.

RESULT: DEPENDABLE PERFORMANCE

Each Ⓟ reorder wheel gives you exactly the same good job as the original. Production goes up and stays up. Costs go down and stay down. This is the promise—and performance—of Positive Duplication.

CALL CINCINNATI TODAY

Solve your snagging problems with the help of Cincinnati's factory-trained specialists. Their wide experience in snagging operations of all kinds is at your service. Just call your CINCINNATI Ⓟ GRINDING WHEEL Distributor or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

PD POSITIVE DUPLICATION

CINCINNATI®
GRINDING WHEELS

*Trade Mark Reg. U.S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

For More Information Circle 632, Page 39

Two new Durasafe models—

For greater protection . . . easier acceptance

Here are two new Durasafe safety glasses that will help make your eye safety programs *work*. Both give workers the type of protection they need, want, and will wear. The plastic and metal Safemaster (F5300) was designed for safety Rx as well as plano lenses. The Flexi-Fit (F9900), which fits 85-90% of plano users, helps you cut plant stocks of sizes, is also available for Rx. Both models give you major Durasafe features.

For better wearer acceptance and greater eye safety, check these durable new Durasafe models. Call your AO Safety Products Representative, or write for bulletin S-1524.

Only AO Durasafe gives you:

Sturdy frames—engineered for industrial use and exposures.

Wider temples, endpieces—stronger, more comfortable, better appearance.

7-Barrel hinges—40% stronger at temple's most vulnerable spot.

Duragrip screw construction—temples stay tight, screws cannot fall out.

Cool side shields—nonreflecting wire mesh.

Choice of temples—wide plastic comfort cable, metal core plastic spatula, or aluminum with plastic spatula tip.

Your Surest Protection . . . AO SURE-GUARD Glasses

American Optical
COMPANY
SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

CarVer RAPID MULLER

Works Equally Well with Any Binder

including CO_2, Bentonite, Facing Sands, Oil Core Sands, Oil Bonded Molding Sands

- **The fastest! A batch every 75 seconds.***
- **Absolutely no lumps or wet spots!**
- **Easiest to clean! Just reach inside.**
- **Only one moving part. No maintenance worries.**
- **3 times lower initial investment than with most mullers!**

*Applies to CO_2 sand. Oil sand may take up to three minutes.

IF YOU COMPARE MULLERS CAREFULLY . . . YOU'LL CHOOSE CARVER

Only CarVer Has Everything For the CO_2 Process!

CARVER RAPID and V & S Core Shooters

CARVER Automatic Gassing Apparatus

KRAUSS Taper Slot Core Vents

STEINEX available only from CARVER

«MAIL COUPON TODAY»

CARVER FOUNDRY PRODUCTS CO. F-14
Muscatine, Iowa

Send me complete information and prices on Carver Rapid Mullers.

NAME _____ TITLE _____

FOUNDRY _____

CITY _____ STATE _____

For More Information Circle 634, Page 39

BOOST PRODUCTION UP TO 25%

MANHATTAN REINFORCED CUT-OFF WHEELS

"MORE USE PER DOLLAR"

- **MORE CUTS AT LOWER COST**
- **FASTER PRODUCTION**
- **GREATER SAFETY**
- **CUSTOM-MADE FOR YOUR JOB**

Job records prove these wheels take the abuse of heavy cutting in foundry operations—far beyond the limits of ordinary cut-off wheels! Here's why:

MANHATTAN REINFORCED CUT-OFF WHEELS ARE REINFORCED TWO WAYS

1. Special fibers in Manhattan's Bond increase by 50% the wheel's strength to withstand destruction by centrifugal force.
2. Super-strength synthetic lateral reinforcement gives a degree of resistance to side-strain not possible with ordinary wheels.

DOUBLE REINFORCEMENT ADDS UP TO DOUBLE SAFETY—AND PROTECTION FROM BREAKAGE, TOO!

Let a Manhattan sales engineer show you how to get "More Use per Dollar" with Manhattan Reinforced Cut-Off Wheels and other types of Manhattan high speed, heavy duty wheels.

ENGINEERED RUBBER PRODUCTS ... MORE USE PER DOLLAR

RM

RM-1064

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

FOUNDRY PROVEN
Dietert-Detroit Moldability Controller attached to sand mill
CONTROL MOLD QUALITY automatically
WITH THE NEW
DIETERT DETROIT MOLDABILITY CONTROLLER

MOST IMPORTANT SAND CONTROL DEVELOPMENT IN YEARS

SIMPLICITY . . . 1. No parts in sand mixer. **2.** No complicated electronic circuits. **3.** No maintenance problems. **4.** No moisture juggling. **5.** No electronic technology needed to understand why unit works.

OPERATION . . . 1. Sand sample is taken from small opening in side of mill. **2.** Water is added from two valves while sand falls through a screen. **3.** Water is cut-off when sand is able to pass over screen. **4.** Discharged sand is of a selected and controlled moldability to give constant ramming qualities. **5.** The Dietert-Detroit Moldability Controller will adjust moisture to produce the proper molding sand while composition is changing under normal plant practice.

SAND CONTROL . . . 1. Sand composition is predicated upon quality of a master or production mold. **2.** Any shift in moisture level means the system sand is changing. **3.** Use laboratory sand tests to determine what change is taking place. Check strength, permeability, fineness and ingredient additions. **4.** Use master mold pattern to measure mold quality with 6 new mold quality tools.

RESULT . . . 1. A greatly improved sand control. **2.** A direct approach. **3.** A positive end-property control obtained with moldability and mold quality control. **4.** A more satisfied group of molders and a sand system that requires much less supervision. **5.** A more profitable operation.

YOU ARE INVITED TO COME TO DETROIT TO SEE THIS DEVELOPMENT

DIETERT DETROIT

HARRY W. DIETERT CO.
9330 Roselawn • Detroit 4, Mich. • *Tel.* WE 3-9790
Send me complete details on your Moldability Controller.
NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

For More Information Circle 636, Page 39

Meet our new baby giant... *the M-G Powered INDUCTO INTEGRAL 15*

... you'll never again be satisfied with Spark-Gap Melters

Inductotherm now offers the greatest space-saving, most economically-operated induction melting system in history. Once you've compared the Inducto Integral 15, you'll never be satisfied with a spark-gap converter. What's more, the 15-kilowatt Integral 15 has the same melting capacity as 20-Kw spark-gap units.

Compare Installation The entire unit occupies only 35" x 40" of floor space. The motor-generator, capacitors, transformers, and all controls are packaged in a single, compact console. Completely pre-assembled and pre-tested before delivery . . . all you do is tie-in power and water lines and you're ready to start melting. Radio shielding problems are eliminated.

Compare Operation Whatever your melting problem . . . in small foundries, in research laboratories . . . you achieve optimum power for fast, efficient melting with minimum metal loss. In addition, the Integral 15 easily maintains a balanced 3-phase load . . . you can connect two furnaces to one power control . . . and it's readily adapted for vacuum melting.

Compare Maintenance No more hydrogen to purchase, store, feed, and dispose. Moreover spark-gap converters operate at extremely high voltages with peaks up to 20,000 volts, while the Integral 15 operates at a constant 220 or 440 volt coil voltage. Safety factors increase, . . . arcing problems drop almost 99 percent. Costly mica insulation between coils is eliminated. In fact, the *only* maintenance needed is routine lubrication.

Compare Cost The Integral 15 costs a little more than spark-gap units. But you start saving money the minute you start operation . . . in time, metal, maintenance and power consumption. You can amortize the cost differential in a matter of months. And your savings are the same whether you purchase an Integral 15 outright or use Inductotherm's unique rental or lease-purchase plans.

Compare the Facts We'll gladly send you complete details on the Integral 15. Write for Bulletin 20-15. Other Inducto "Integral" models available with capacities of 30, 50, and 100 Kw. Address: Inductotherm Corporation, 412 Illinois Avenue, Delanco, New Jersey.

INDUCTOTHERM

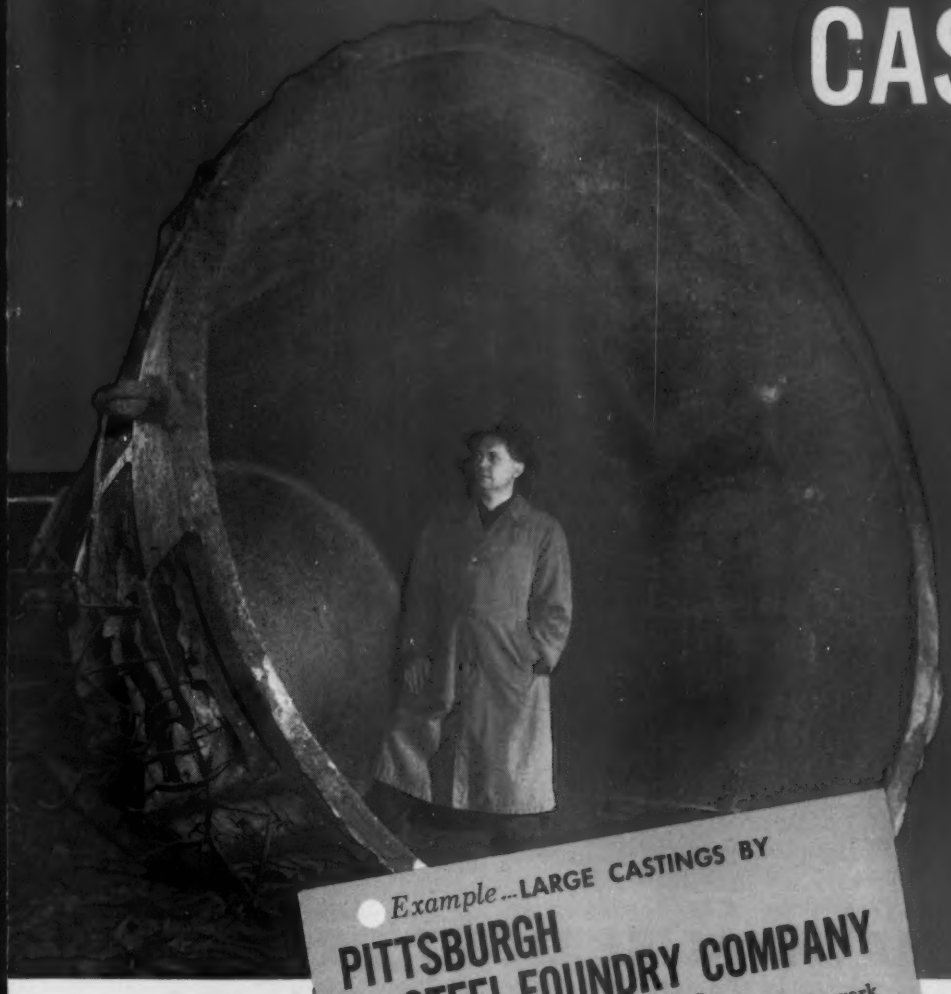
Special Trade-In Offer

*Realizing that the Integral 15 obsoletes many spark-gap units just a few years after purchase, Inductotherm plans to share this early obsolescence with their customers by offering a trade-in allowance of 50% of the original purchase price of 20 Kw Inducto spark-gap converters toward the purchase of the new Integral 15. This offer applies only to **original** purchasers of 20 Kw Inducto Melters and may be withdrawn at any time.*

For More Information Circle 637, Page 39

Circle 638 on Page 39→

America's MOST ADVANCED CASTINGS are being made by the



Example—LARGE CASTINGS BY

PITTSBURGH STEEL FOUNDRY COMPANY

TEXTRON INC.

Representative of this progressive organization's work with KOLD-KURE—a 400 cubic ft. steel slag ladle, with 5" metal sections.

KOLD-KURE® NO-BAKE PROCESS

The world's most advanced binder, KOLD-KURE performs like KOLD-SET, while eliminating completely the baking process. *Main Characteristics:* Assured dimensional accuracy in finished castings . . . Excellent sand flowability and collapsibility . . . Sharply reduced rodding . . . No objectionable odors . . . Simplified mixing . . . Only two additives—activator and binder.

A TEST IN YOUR FOUNDRY? Let our Technical Service Specialists demonstrate how you can make more profitable castings—through the KOLD-KURE Process.

Let us send full details

NEW TECHNICAL BULLETIN

This will answer essentially all the technical questions you likely will raise.

PRODUCTS FOR FOUNDRY PROGRESS

G. E. SMITH, INC.

246 WASHINGTON ROAD
PITTSBURGH 16, PA.

Warehouse Stocks in Boston • Chicago • Philadelphia • Detroit • Indianapolis
San Gabriel, Calif. • Hamilton • Toronto • Montreal

How the Foundry Industry Serves America . . . #14 of a Series

SHOULD A MATERIAL BE LIGHT OR RIGHT?

The properties of cast iron make it practically ideal for a great many uses. Why "practically" ideal? Because the industry has heard a lot of promotion and commotion about just one thing lately—and that's *weight*. But the importance of saving weight is relative; the ability to do the job comes first. Otherwise cars, and coins, could be made of wood or feathers or cork.

For example, why take a part made of a hard, dense material like cast iron—with its high tensile strength and ability to stand up to extremes of heat, vibration and friction without getting tired—and substitute another, more expensive material (with fewer of these characteristics) *simply because it is not as heavy?* Replacing the right material with a lighter one could affect production costs so that the pounds saved would be the most expensive pounds of all!

Since customers today are demanding *more* dependability and many manufacturers have *lengthened* warranty periods, is this the time to trade long life for high-priced lightness?

Leading engineers and designers, along with their colleagues in the iron foundry industry, believe that this is the time to use materials with the natural characteristics best suited to the job, and make *them* as light as possible through design and engineering. Together, they have already developed iron castings that reduce vehicle weight—economically.

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READERS' COMMENT

Research Alone Not Enough

To The Editors:

It is indeed pleasant to see a man handle a rifle in a professional manner. I am referring to the article by H. W. Lownie Jr., in your March 1961 issue under the title "Research and Gray Iron Castings."

I am certain that the greatest reward which Mr. Lownie can possibly receive will be the acceptance and some action upon the recommendations which he made. There are a few points, however, that should be added to the over-all thinking if such a program is considered.

A very subtle point lies in an interpretation of just what a company is in business for. Obviously, it is to make a profit, but in so doing a company must first discover and then serve a very definite need. In the case of the foundry business, it is usually an engineering need of some sort.

By keeping this in mind, we relegate the business of making castings to the level of a medium by which the need can be served and a profit made. This sounds like an indistinct point, but it does change a businessman's thinking and can change his path as he reaches for the profit objective.

A second point revolves around one of the great difficulties with research in the foundry industry during the past. Too often these research results are reported without identifying the conditions under which the findings can be applied. Foundrymen fail because other conditions are not the same as those which prevailed when the research findings were successfully demonstrated. Research results are definitely not for "fast reading." You simply have to read the fine print and perhaps even check some of the references before even attempting a trial in your own plant.

I believe that the above is responsible for the apparent duplication of effort which seems to be continuous in the foundry industry. If the conclusions and recommendations of a research report do not work out profitably with a company, then the research is wrong. Thus, another research project is started to cover essentially the same ground before intelligent attempts to employ previous results are concluded.

And perhaps the one great gap which affects all research work, particularly in the foundry industry, exists between the findings and conclusions of a research project and its application in the foundry itself. Before any research can be of value to the industry, there must be the kind of people in the company who will open-mindedly accept these findings and then apply them in an accurate manner.

This brings us down to the plant level and the seeming disregard of the supervision on the floor of the foundry where these new ideas must be put into operation. For some reason, scientists and engineers, as well as research laboratories, are paid substantial fees for developing data which will help make the industry progress, but then it is expected that the foreman can immediately assimilate all of this technology, merely by reading a report. Miracles are expected of him, but somewhere along the line someone forgets to pass along the magic wand.

Actually, a bridge of talent between research and its application is required. Most foremen are intelligent men without the benefit of a technical education. It takes engineering or metallurgical education to translate data into results—be it in production or in product application.

And management must realize that Research and Development progress is actually built on failures —that unwarranted criticism can choke off a drive towards success within the organization, that "Trouble is the Price of Progress," and that this trouble is nowhere near as bad as the trouble that comes because of no progress.

The whole point is this—that any research result that has application in the industry must include in its cost a manner and means whereby this information is going to be passed along, and the men who are sup-

In the interest of the American foundry industry, this ad (see opposite page) will also appear in

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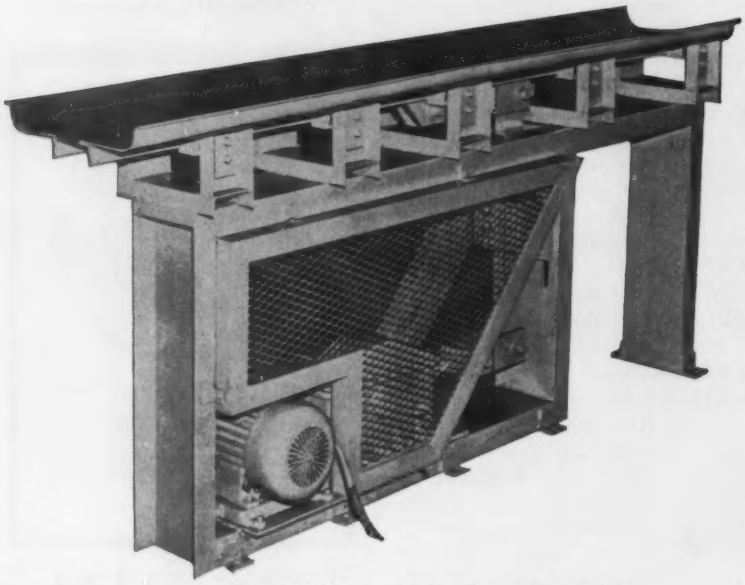

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posed to apply it can be indoctrinated into the proper procedures. Without this, there is no value in even starting a research program.

GEORGE K. DREHER
Market Development Director
Steel Founders' Society of America
606 Terminal Tower
Cleveland, Ohio

Attitudes Need Changing

TO THE EDITORS:

I was moved to stand up and cheer on St. Patrick's Day, but not because I'm Irish. Your March, 1961 issue reached my desk. I actually started by reading the editorial and immediately jumping to Howard Taylor's comments on Page 99.

Let us hope that the entire foundry industry asks for additional copies so that those on the lower rungs in the foundry organizations will read it, too.

Probably therein lies the hope for the salvation of the foundry industry. Of all segments of the metalworking industry with which I have personally dealt over the last 15 years, the foundry industry has shown by far the greatest resistance to change.

It is inconceivable that such an important segment of industry should allow trends indicated in Mr. Lownie's article to continue.

It isn't lack of basic research or even lack of applied research that is the principal source of difficulty. These are merely symptoms. The attitudes we find in the minds of most of the foundrymen we encounter are in dire need of change. No doubt the foundrymen can find valid reasons for the obvious decrease in utilization of castings. We can have performance or alibis but, as we all know, we can't have both.

What I can't figure out is what is blinding the foundrymen. Certainly the obvious success enjoyed by some individual foundries as a consequence of expenditures for research effort, for intelligent sales engineering, for market research, for experimental stress analysis and product development, and above all, for intelligent use of quality control tools should be apparent to even the most myopic foundryman and stimulate him to go and do likewise.

KERMIT A. SKEIE, Manager
Material Testing Laboratories
Magnaflux Corp.
Chicago 31, Ill.

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Circle 641 on Page 39→

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We chose an impeller for this ad because the very efficiency of a fire pump may depend on this single casting and unless the vanes can be cast with a clean smooth surface there is no way to deal with roughness.

KORGLAZE will show equal value for all types of metal, and when used on shell cores or molds it preserves the silvery sheen of aluminum and magnesium.

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Specially designed lamp used to examine inner "as-cast" surfaces of the above impeller casting at Hale Fire Pump Co.

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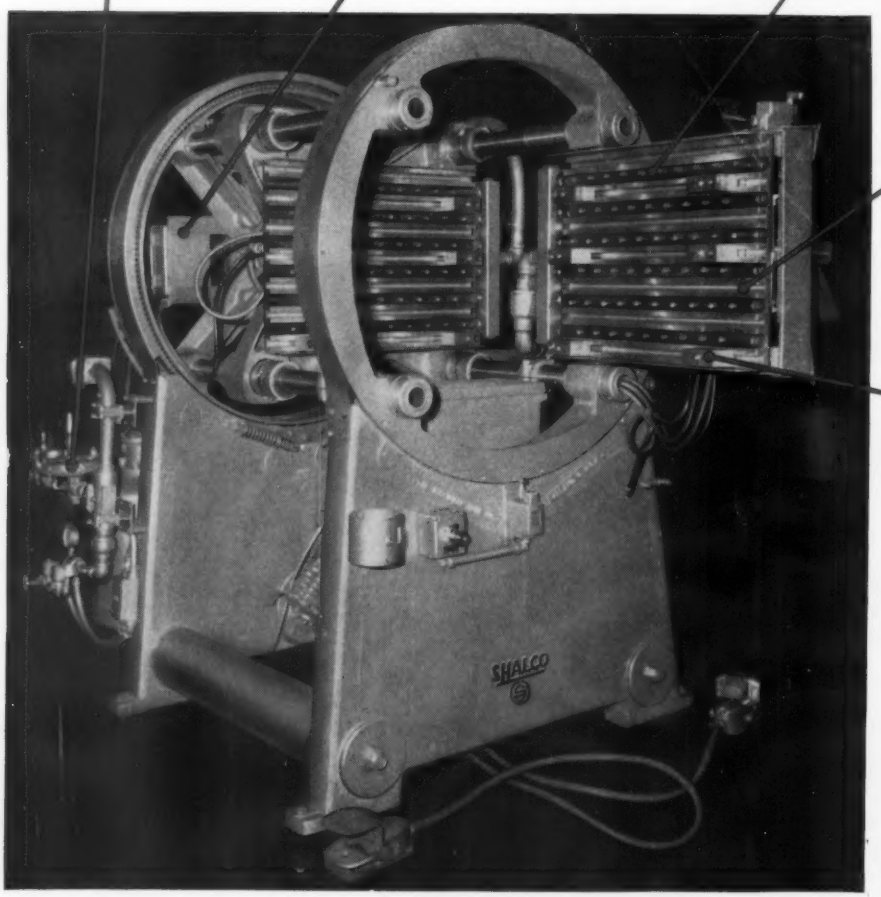


Back Plate complete with tee slots for block adjustment.

Adjustable blocks for securing core box—this allows for maximum area of box to be exposed to tips. Cold spots are eliminated with ample space available for tip lighting.

For More Information Circle 644, Page 39

Creative Competition

Several articles in this and recent issues point out how the foundry industry can benefit more from the built-in advantages of the metal casting process.

Recommendations applicable to specific types of castings are included in several of the eight articles making up our special report, "Meeting Competition Through Improved Foundry Technology," which is presented on the following 34 pages.

Suggestions by foundry authorities and users of castings concerning promotion of the industry's growth emphasize these requisites:

- Make more effective use in the foundry of available technical knowledge to upgrade casting quality.
- Get better acquainted with the designer's problems and with methods for improving the design of cast parts.
- Do a better promotional and educational job among consumers to demonstrate how castings can be applied advantageously to their products.

There's nothing new in these proposals. Their importance was recognized long ago by a number of foundries, and the success these companies have enjoyed attests to the worth of the formula.

Unfortunately, such foundries frequently suffer from the competition of producers who place more emphasis on price than on quality. This situation will continue until 1) there is better recognition by users of castings that quality has its price and 2) foundries generally seek only that business in which they compete with shops offering comparable quality and thus can command a fair price for that quality.

Naturally, such a change will not be achieved overnight, but its development is being accelerated by the growing demand of consumers for improved quality and reliability. The progressive foundry which is able to meet the challenge posed by these stricter specifications automatically will reduce the number of its competitors and create a larger volume of potential business for itself.

William G. Reichelt

Editor

Meeting Competition Through Improved . .

FOUNDRY TECHNOLOGY

By WILIAM G. GUDE
Editor

More intensive application of modern operating practices is needed for foundries to meet the competition of other methods of fabrication—and to reverse the recent downward trend in total demand for castings

● EIGHT YEARS ago FOUNDRY presented a detailed report of postwar developments in the castings industry. On succeeding pages of this issue, seven authorities in their respective fields tell what has happened during the intervening years.

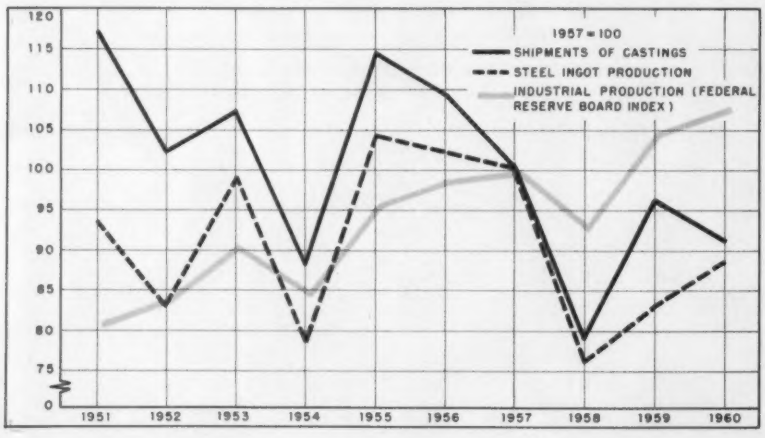
These seven analyses provide a mixed picture of gains and losses. Substantial progress in the form of technological improvements and broadened markets for some types of castings are in marked contrast to the failure of demand for some other types to keep pace with a growing economy.

As everybody knows, intensified competition prevails today in all major industries, including metal casting. This situation makes it mandatory that foundries employ the most efficient tools and processes available if their products are to compete successfully with those made by other methods of fabrication. It also requires abandonment of the old notion that the buyer will seek out the better mousetrap without being prodded.

Contracting Markets—In charting the future it might be well first to review what has occurred in markets for castings during the recent past.

The decade of the 50s had both good and bad years for foundries, but over the ten years the long-term trend in total shipments of casting was downward. This trend is evidenced in Fig. 1, which also charts the ups and downs during the same period for steel mill operations and general industrial production as measured by the Federal Reserve Board index. Trend of the latter, except for 1954 and 1958, was consistently upward.

Fig. 1—During the last five years both foundry and steel mill operations have tended downward while general industrial production has been rising



There are several explanations for this failure of foundry output to keep up with the parade. Note in Fig. 1 that since 1955 both steelmaking and casting operations have been losing ground in relation to industrial activity as a whole. To a degree this situation reflects the slower tempo in some durable goods and the increased importance to the over-all economy of soft goods and certain other industries which are relatively small consumers of cast and wrought metals. It is simply a case of such industries accounting for a larger slice of the whole industrial pie because they have grown faster than the metals industries.

Castings Go Further—Then there is the undeniable fact that to perform a given function, fewer pounds of cast metal—or rolled steel, for that matter—are required in many cases than were used a few years ago. For example, compare the weight of the engine of today's compact car with that of its predecessor which delivered the same horsepower.

In response to demands of customers, foundries are supplying castings of improved design which provide greater strength, thinner sections, and closer dimensional tolerances—the net result of which is less weight.

The Steel Founders' Society of America estimates that today's steel casting offers close to 20 per cent greater intrinsic value from the standpoint of how it performs its

function compared with the one supplied ten years ago.

Since business volume of the foundry industry normally is measured by the weight of castings shipped, it is not completely accurate to compare today's tonnages with those of a decade ago. Another circumstance which makes such a comparison erroneous is the growing substitution of aluminum for heavier ferrous metals for certain applications, such as engine blocks.

Other retarding factors which have influenced casting demand include the disappearance of certain markets through natural evolution (we no longer build steam locomotives, for example), increased use of plastic products, and rising imports of items containing castings.

Divergent Trends — Aluminum and zinc castings have moved contrary to the trend in demand for castings as a whole. As indicated in Fig. 2, shipments of these two types of castings during the last ten years have pushed irregularly upward, whereas activity in other grades has tended downward.

Expansion of the diecasting industry has been a major factor in this trend. For many years, of course, the diecasting process has predominated in the production of zinc castings. In aluminum, however, diecastings represented only 32 per cent of the 1950 output. This percentage grew to 45 per cent in 1958, to 47 per cent in 1959 and to 48 per cent last year. During these three years the share of permanent mold castings was steady at 34 per cent.

The Next Decade—What knowledge gained during the last ten years will prove useful to foundries in the coming decade? Technologically, there has been considerable progress which can be put to good use. Most of these developments, listed below, have been refinements or more general application of improved practices instituted previously.

- Probably the most important new products introduced in recent years have been improved sand binders for cores and molds.
- A number of new alloys have been provided for both ferrous and nonferrous foundries.
- Pearlitic malleable and ductile irons have created new markets for ferrous foundries.
- Faster and more precise molding machines have been developed.
- Melting units have been made more efficient.
- Modern cleaning equipment does a better job than its predecessors, and effective inspection tools are available to check the quality of what the foundry produces.
- Marked improvements have been made in the diecasting and investment casting processes, including ceramic molding.

Helpful though the above developments are, there still exists a crying need for much more research and study of foundry processes and materials. The lag in this respect is a serious deterrent to progress. Nevertheless, experience has proved that today's tools, if used properly, will permit production of the high-quality castings required under today's competitive conditions.

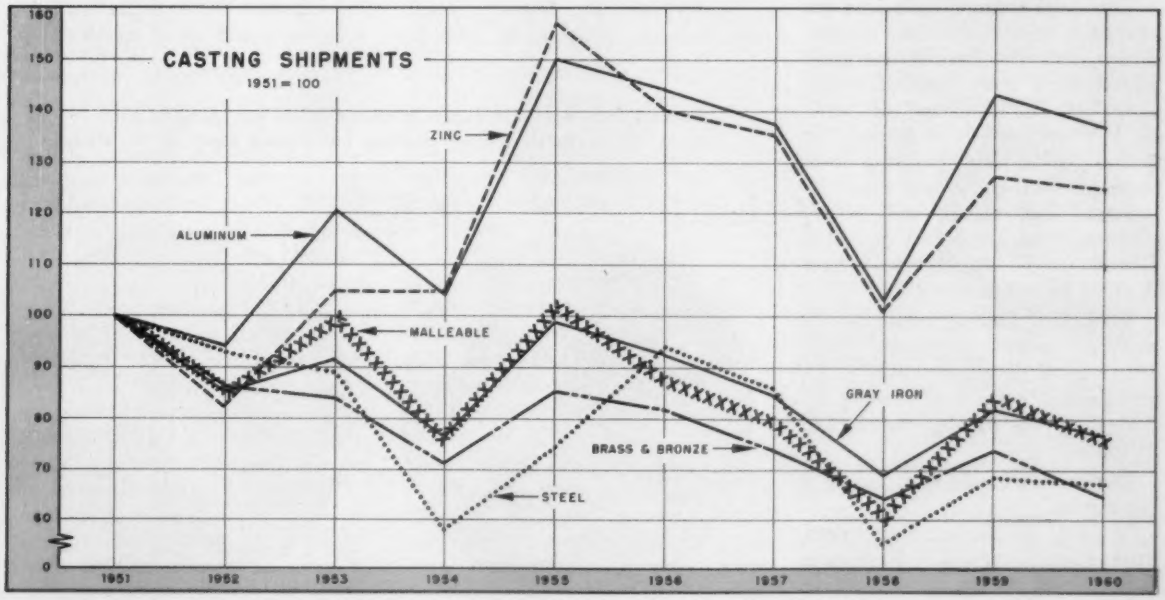
The Other Ingredient—Efficient methods and an adequate product comprise only one of the two ingredients needed to assure success in the years ahead. The other is more rigorous market development.

Some time ago, progressive foundries recognized the need to junk the timeworn practice of waiting for prospective buyers of castings to seek them out. Spurred by the programs of leading trade associations, these foundries are attempting to let designers know what castings can offer as reliable components of a complete, manufactured product, and to assist them in providing those components in the most efficient form at the lowest cost.

Such a program will provide maximum effectiveness only if it receives industry-wide support.

Fig. 2—Trends in shipments of castings since 1951 have varied by types of metal. Only those of aluminum and zinc have been upward

• For an extra copy of this article, until supply is exhausted, use card on Page 39



Steel Castings

. . . have been improved by new technical developments in every major operation of steel casting production since 1953

By CHARLES W. BRIGGS
Technical and Research Director
Steel Founders' Society of America
Cleveland

● TECHNICAL developments have been made in every major operation of steel casting production during the eight-year period of 1953 to 1961. Before listing these accomplishments, however, it is perhaps advisable to look briefly at the changing picture in the distribution of sales. The accompanying diagrams indicate the major applications of steel castings according to end use.

The major changes have been the alteration in classifications consolidation and the greater emphasis placed on a more detailed breakdown of end-classifications based on a better analysis of markets. In general, road and building construction and equipment have increased, and valves and piping equipment have dropped off. Also, miscellaneous applications have doubled in recent years.

1946-1953 Developments — A previous article (FOUNDRY, May, 1953) listed developments of major significance in the steel castings industry. These may be summarized as follows:

Design: Cast-weld and composite fabrication.

Molding Methods: Finer sand, green sands extended to large castings, reproducibility.

Molding Equipment: Semiautomatic equipment, expansion of core blowing, dielectric baking, wet and pneumatic sand reclamation.

Material Handling: Detailed analysis of the use of lift trucks, conveyors, monorails, palletizing.

Metal Flow and Heat Transfer: Gating studies, riser calculations, necked-down risers, distance risers feed, effect of chills, exothermic compounds.

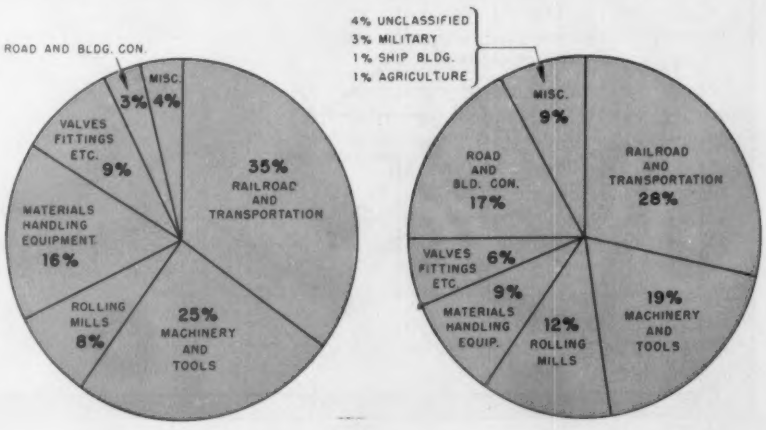
Steel Production: Use of oxygen, thermocouple temperature control, studies in hydrogen and nitrogen, boron-treated cast steels.

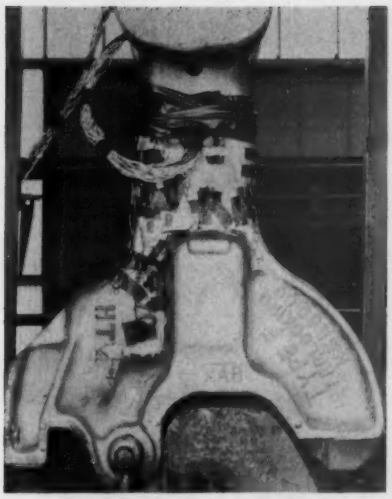
Heat Treatment: Water quenching extended to large castings.

Cleaning of Castings: Development of flame washing and arc-air tools.

Many of those techniques were carried on in the industry to a limited degree but during the last eight years they have been adopted fairly universally by the steel casting industry; for example, the wide acceptance and use of arc-air equip-

Diagrams show how distribution of steel castings has changed from 1950, left, to 1960. Better market analysis has caused some of the changes





Stress analysis has helped to improve casting design. Strain gages, as shown, may be used

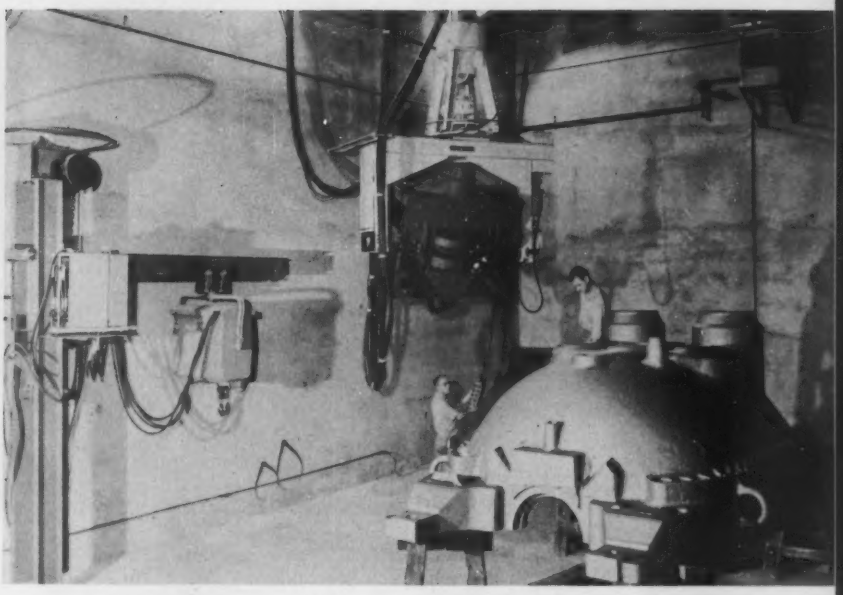


Photo shows a large steel casting being set up for a radiographic check of internal soundness by means of a 22-million volt betatron

ment for metal removal in the cleaning of steel castings, the employment of oxygen in melting, wet and pneumatic reclamation of sands, and the designing of castings to cast-weld and composite fabrication.

Several developments have created considerable interest to steel foundrymen during the last eight years:

Casting Design—Much effort has been devoted to steel casting design problems, and much more detailed knowledge has been given the industry and its customers on the design of joining sections and the employment of proper casting design for the ultimate in section modulus.

Much attention has been given through contests, publications, lectures, and motion pictures for educational purposes to the advantages and possibilities of redesign of all structures, including castings, with the purpose of reducing stress concentrations and thereby improving quality, weight, and costs. Photoelastic analyses have been made of casting and weldment designs, and stress analysis and comparative testing have shown that factors which concentrate stresses are disadvantageous to structures. Because of their adaptability to streamline design, castings, however, always are favored.

Also, studies have been made on stress concentration factors and load-carrying ability of various steel casting designs, and comparisons have been made of these designs on the basis of fatigue and strength requirements. Studies of this type take considerable time and are very costly. However, they develop information that is sorely needed by the design engineer.

For example, a three-year research costing over $60,000 was undertaken on the correlation of nondestructive testing of steel castings with stress analysis under simulated operating loads, including studies on mechanical testing and testing-to-failure of the castings. The studies showed that stress concentration far overshadowed internal discontinuities as locations of final failure.

Brittle lacquer stress analysis and strain gage measurements have shown the importance of using steel castings as parts for industry, and greater use is being given to these tools and their adaptation by manufacturing companies and steel foundries.

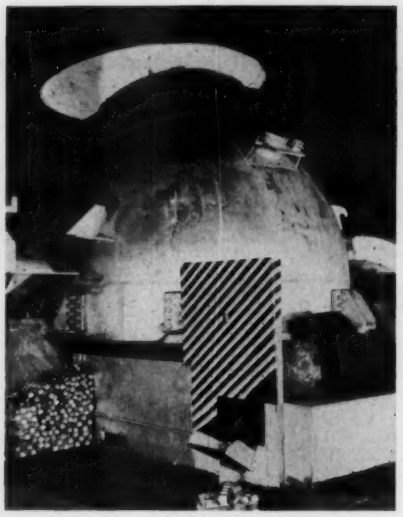
Coremaking and Molding—The use of shell cores of all types is probably the most outstanding development in molding operations. These cores are used in green sand and core assembly molds much more frequently than they are used in shell molds. The industry is producing castings in shell molds, some of which are very large, 5 ft in one dimension, but the shell mold development is not moving as fast as shell core operations.

Cold setting core binders and no-bake core binders are having good development experiences. Almost all producers of large castings are working with cold-setting binders. Sodium silicate-CO_2 cores are being employed in fairly substantial quantities but very little mold production has resulted from this process. Green sand molding is lower in cost and can produce comparable tolerance requirements and, hence, it is the dominant molding method in the steel casting industry.

Consideration has been given by a small group of steel foundries to the ethyl silicate process of ceramic molding. There is no particular growth in this field such as in the use of the new development of investment shell molds. This latter cost-saving method still permits the close tolerances of the solid mold investment method.

Olivine and forsterite facing sands are being employed in resin-sand shell molding and for the production

Use of carbon arc-compressed air tools to remove pads, defects, and riser bases has eliminated chipping entirely in some cases



Basic oxygen process is a new development for steelmaking

of austenitic manganese castings with very good success. Excellent surfaces are being obtained which can not be secured in silica sands. Raw material specifications have been developed for washed as well as crude sands, cereal binders, and bentonite, and specifications may be used. This is the first time that specifications have been made on foundry raw materials for an entire industry. The liquid limit test, a new test for bentonite, was developed through research.

Molding Equipment—Many steel foundries have installed wet and pneumatic equipment for the reclamation of sand used in green sand molding. Shell molding equipment is used now in most steel foundries. In one case the equipment is very large and completely automatic and the only molding equipment in the steel foundry.

Several steel foundries have completed operations for the mulling and distribution of sand automatically. Also, pneumatic conveying of sand and bulk materials is already employed or being considered by foundries. Diaphragm molding equipment has been installed by a few foundries with a number of others giving careful consideration to the use of this equipment. Foundrymen are watching molding equipment developments closely because they are not completely pleased with equipment currently available.

Steel Production—Studies of deoxidation variables and inclusion control have been of considerable interest during the last eight years because emphasis is being placed on cast steels of very high strengths. Good ductility compatible with the high strength is possible through control of deoxidation and steelmaking.

Research has shown that inclusion types can be adjusted by the use of rare earth metals and that the quantity of inclusions can be kept to a minimum by desulfurization. Interest has been aroused in desulfurization of the bath directly after meltdown when the carbon content of the melt is at a high figure.

The greatest interest in steelmaking in the last few years is vacuum degassing of the molten steel following its production. Three companies that produce steel castings in the United States, and several steel casting producing organizations in Europe, are vacuum degassing steel. It is true, however, that only a few steel castings are poured with vacuum degassed steel so far, and not too much information is available. Most of the vacuum degassing capacity is being used for ingots, but one producer is pouring rolls with vacuum degassed steel.

Several foundries are casting leaded steels. The major field for these is in alloy cast steels for the 100,000 to 150,000 tensile strength class since machinability is greatly improved by the addition of small amounts of lead. With all the various steels such as leaded, boron, stainless, residual aluminum, and others, element determination by spectograph is practically necessary. A number of foundries have installed automatic spectrographs during the last few years and interest is growing.

Another new method is termed pressure pouring. The ladle of steel is placed below floor level in a pressure tank and a refractory tube is run up from the ladle into the mold. Air pressure is forced on the molten steel in the ladle and the molten steel pushed up the tube into the mold. Releasing the air drops the remaining steel back into the ladle.

Metal Flow and Heat Transfer—Research has provided a much better understanding of the fundamentals of steel flow in sprues, runners and ingates in recent years. The influence of gating on nonmetallics has been studied by various organizations, with attention being directed to whirl gates, and traps of various types. A highly efficient whirl gate has been devised for steel.

Additional detailed information has been made available on riser feeding efficiency and riser calculations. Charts based on research of

scientific risering are being employed daily in steel foundries. Detailed information through research also has been given the industry on exothermic material riser sleeves for efficient feeding action. Also, much attention and study recently has been given to the use of metal and refractory mold inserts to produce small permanent passages through castings, or to carry water or air to act as cooling surfaces in the solidification of castings.

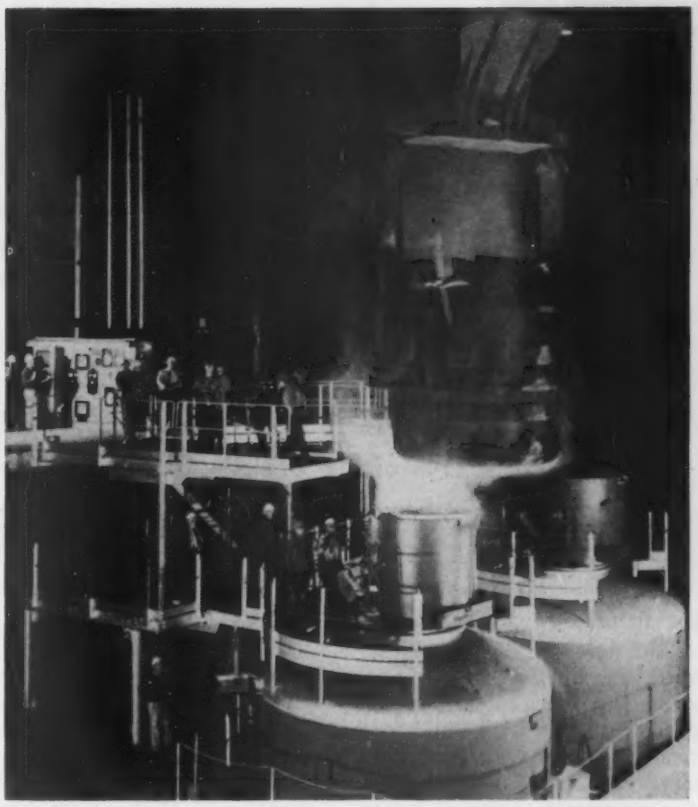
Cleaning Castings — So much progress has been made with the use of carbon arc-compressed air tools to remove defects and pads that many steel foundries have several units which, in a few cases, have supplanted the chipping hammer entirely. The use of large carbon rods with high amperage equipment is the present trend.

Blast cleaning research has permitted savings through the use of proper abrasives. In fact, two abrasive specifications have been prepared and distributed to the industry to help the foundry operators purchase quality abrasives.

CO_2 and shielded metal arc welding are being used on a limited basis in the industry, but probably there will be greater application of these methods in the next few years.

A number of machining studies have been made in recent years on steel castings. These studies have shown that faster speeds and feeds can be used on the base metal, and comparative tests of cast vs. wrought steel show that little or no advantage exists in the machinability of wrought or cast steel of similar composition and heat treatment. The recent development of disposable carbide tips permits the machining of casting surfaces at the same machining rates and conditions as that of the base metal.

Heat Treatment—The most important technical development in cast steel heat treating operations is the research, development, and commercial application of short cycle treatments. Substantial costs and considerable heat treating time have been saved by following the recommendations developed through the research studies. Castings of 2- to 3-in. sections which normally would take 6 to 8 hr to heat treat and hold at temperature prior to cooling, now are heat treated in less than 1 hr to obtain the same, or better, mechanical properties.



View of vacuum chambers shows a furnace ladle pouring into a 15-ton pony ladle. Vacuum is applied to the melt to remove gases

Another new development is the explosive hardening of austenitic manganese steel. This steel in its tough state, following a quench from a high temperature, can obtain surface hardness for abrasion resistance by explosive hardening. All that is required is to have sheets of explosive laid over the casting faces which need working. The explosive blast cold works the surface and prehardens the areas prior to service application.

Inspection—Considerable interest has been given by the steel casting industry to the entire subject of tolerances, and a number of studies on an industry basis have been made. The result is that tolerances have been tightened and the industry is equipped to do a much better job than was done eight to ten years ago.

Radiographic and magnetic particle testing have continued with increased impetus, and use is being made of large sources of Cobalt 60 for steel radiography. Reference photograph standards and techniques have been developed and published for magnetic particle testing, and they are being specified at the present time.

Miscellaneous — Attention has been given to plastic patterns, their manufacture and use, and the technical developments which have gone forward continuously during the last eight years have been followed carefully by the steel foundry industry.

Also, greater use has been made of methods analysis, work simplification, memomotion studies, and incentives by steel foundry operators.

Many of these technical advancements have been made through research by both steel foundrymen and suppliers. The development has been largely by foundry operating executives pushing forward the use of new methods or applying the use of new equipment to their operations.

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Aluminum Castings

. . . have gained greater acceptance in the automotive industry with the introduction of diecast and permanent molded aluminum engine blocks

● THE BIG NEWS in aluminum castings since 1953 has been their use in automobile engines. Consumption for other automotive parts has increased steadily in recent years, but demand for lighter cars and better fuel economy brought the development of cast aluminum blocks and the greatest single increase in use of aluminum. Today, aluminum engines are standard or optional equipment on seven cars, and more are being considered.

Although somewhat overshadowed by the aluminum automobile engines, other new uses for aluminum castings have been developed during the past seven years. One is in guided missiles, where weight saving is of paramount importance and a high degree of reliability is required.

Aluminum castings are being used more often in applications involving fluids under pressure, as in compressors, pumps, and hydraulic control mechanisms. New highway applications include cast railing posts, sign structures and lighting standards. Aluminum bearings have shown increased acceptance in recent years, especially for heavy-duty applications, and a new use which appears promising is cast aluminum electrical insulator caps.

Production of permanent mold, semipermanent mold, and diecastings has increased markedly in recent years because most aluminum castings used by the automotive industry are produced by these methods. At the same time, production of aluminum sand castings has shown a sharp drop.

Continuing research has enabled aluminum foundries to meet an increasing demand for castings with higher strength and more uniform quality and at the same time to hold costs down so that aluminum castings can maintain their competitive position. Higher strength is being achieved through new alloy developments. Properties approaching those of wrought aluminum products are now being attained, especially in permanent mold and semipermanent mold castings. Sand castings with closer dimensional tolerances and smoother surfaces are being made with shell and CO_2 cores and molds. These cores also are being used extensively in the semipermanent mold process.

Increased mechanization has helped the aluminum foundries in their continuing battle against costs and also has aided in achieving greater uniformity by reducing foundry variables. A significant development in recent years has been a trend toward performing all or at least part of the machining required. Also, usefulness of aluminum castings has been broadened by the extended use of color finishes. Today, all types of finishes are being applied to castings, including porcelain enamels.

Alloy Developments—Recent alloy developments include the "high-purity" versions of alloys 355 and 356, known respectively as C355 and A356. The high-purity designation refers primarily to iron content, which is held to a maximum of 0.20 per cent in both alloys. Table I shows some recently developed aluminum casting alloys and their compositions. When heat-treated to the T62 temper, alloy C355 attains 52,000 psi ult str in permanent molded test bars with 44,000 psi yld str and 4 per cent elong.

Higher ductility is obtained in the T61 temper, with some reduction in tensile and yield strengths. (The T6 temper is attained by solution heat treatment followed by artificial aging or precipitation hardening. Tempers T61 and T62 are variations of T6 in which different precipitation-hardening temperatures and times are used to obtain different combinations of strength and ductility. All mechanical property data given in this article are based on tests made on separately cast standard-sized test bars. Those cast in green sand or permanent molds are ½ in. in diam; standard diecast bars are ¼ in. in diam.)

Alloy A356 in the T61 temper has about double the ductility of the standard 356 alloy in T6 temper, based on permanent mold specimens, and at the same time its tensile and yield strengths are higher. In the T6 temper, alloy A356 has 15 per cent elong, which makes it particularly useful for parts subject to high impact loads, such as

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Plaster cores, like these being assembled into a mold for a tire mold tread ring, are being used more extensively by aluminum casters to meet demands for high-quality, close-tolerance castings of intricate design

heavy-duty truck suspension parts.

Alloy 357 is similar to A356, but contains a higher percentage of magnesium. Solution heat-treated and artificially aged permanent mold test bars show an average 52,000 psi ten str, 43,000 psi yld str, and 5 per cent elong. Sand-cast specimens after similar treatment show tensile strength of 50,000 psi ten str, 43,000 psi yld str, and 2 per cent elong.

One of the newest high-purity aluminum-silicon-magnesium alloys is X359, which contains more silicon and magnesium than alloy 357. It shows substantial increases in tensile and yield strengths over alloy A356 and retains higher elongation than similar alloys. Permanent mold test bars show 49,000 psi ten str and 37,000 psi yld str, or about 20 per cent above those of A356-T61. In the T62 temper the yield strength is 35 per cent higher.

Alloy 364 is a diecasting alloy which contains chromium and beryllium in addition to silicon and magnesium (see Table I). Common impurities are controlled at normal levels. Diecast test bars of this alloy in the as-cast condition typically show 43,000 psi ten str, 23,000 psi yld str, and 7.5 per cent elong. Artificial aging increases the field strength 10,000 psi and reduces elongation only 2.4 per cent. Annealing increases the elongation to 11 per cent so that in this condition the alloy is particularly attractive for applications requiring assembly of diecastings by rolling,

This transmission housing is typical of large automobile parts that are being cast of aluminum. In this case, a permanent mold is being used

spinning, or riveting operations.

Silicon content gives all of the above alloys excellent casting characteristics and good resistance to corrosion.

The increased demand for compressor, pump, and similar castings has resulted in a renewed interest in alloy 333, which is being produced to closer composition limits than in the past. This is a permanent mold alloy nominally containing 9 per cent silicon and 3.8 per cent copper. Permanent mold test bars of this alloy in the as-cast condition have 34,000 psi ult str, 19,000 psi yld str, and 2 per cent elong. Heat treatment increases tensile and yield strengths to 42,000 and 30,000 psi, respectively, and reduces elongation to 1.5 per cent.

Another development stimulated by the increased demand for these types of castings is a refining process to control shrinkage porosity. Known commercially as the PT process, it is applicable to most of the commonly used sand and permanent mold casting alloys.

A newer alloy that has had some application is 363 which, in addition to 5.5 per cent silicon and 3 per cent copper, contains 3.5 per cent zinc. This alloy is suitable for both sand and permanent mold casting, showing as-cast properties in permanent mold specimens of 35,000 psi ten str, 23,000 psi yld str, and 2.5 per cent elong. Heat treatment increases the values to 46,000 psi, 28,000 psi, and 5 per cent, respectively. Properties of sandcast specimens are somewhat lower.

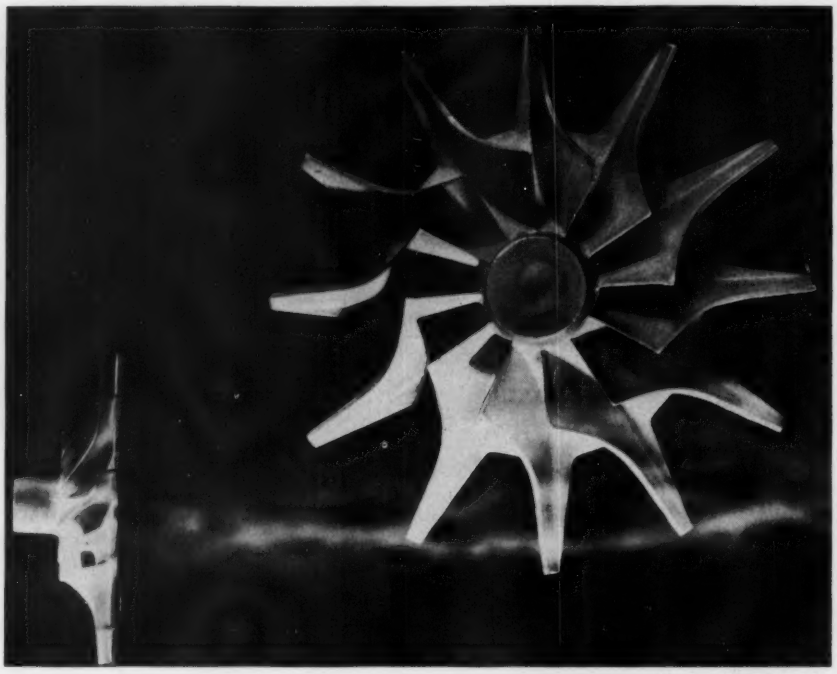
In the same general category is the so-called "Z" diecasting alloy, which basically is an aluminum-copper-silicon alloy of the familiar 380 type with an allowable zinc maximum of 3 per cent. This alloy has become increasingly popular among the larger diecasting producers and users because of the economy available without sacrifice of castability, mechanical properties, or casting service life. Addition of zinc also improves machinability.

A new alloy of a more specialized type is X385, a diecasting alloy with good bearing characteristics and tensile, compressive, and fatigue properties comparable with those of other aluminum diecasting alloys. This also is an aluminum-silicon-copper alloy, but it contains tin, lead, and cadmium. Use of this alloy is advantageous in parts involving integral bearing surfaces, its first commercial application being in connecting rods for air conditioning compressors. In parts such as these, use of this alloy obviates the need for cast-in or subsequently assembled bearings or bushings.

The recent use of aluminum castings in automobile engines has led to renewed interest in the hypereutectic aluminum-silicon alloys, particularly those containing about 20 per cent silicon. These alloys have lower coefficients of expansion than commercial aluminum alloys; and they are hard and have good wear resistance.

Their difficult casting and machining characteristics still pose a problem, although this problem has been greatly mitigated by phosphorus modification, which produces an improved cast metal structure. Today they are being used to a limited extent for pistons and for a few other parts such as sheaves and pulleys. Because of their resistance to wear, they are being considered for engine blocks without iron cylinder liners, for cylinder liners in aluminum blocks of other alloys, and for brake drums.

Although the major effort in al-



Aluminum Co. of America

Another application of plaster in the aluminum foundry is making molds for precision castings such as these close-tolerance impellers

TABLE I—Compositions, Recently Developed Aluminum Casting Alloys

Alloy (Commercial Designation)	Sand (S), Permanent Mold (PM) or Diecasting (D) Alloy	Nominal Composition, % (Remainder Aluminum)				
		Silicon	Copper	Magnesium	Zinc	Other Elements
A140	S, PM	..	8.0	6.0	..	0.5 each, Mn and Ni
C355	PM	5.0	1.3	0.5	..	.....
A356	PM	7.0	..	0.30	..	.....
357	S, PM	7.0	..	0.5	..	.....
X359	PM	9.0	..	0.6	..	.....
363	S, PM	5.5	3.0	..	3.5	.....
364	D	8.5	..	0.30	..	0.30 Cr; 0.03 Be
X385	D	5.0	3.7	..	..	0.7 each, Sn, PB, Cd
Adaptaloy	S	1.0	1.8	..	..	1.0 Mn
Z	D	8.0-9.0	4.0	..	3.0 max	.....

loy development has been in the direction of higher strengths, at least one new alloy has been introduced for simple castings requiring only moderate strength and relatively high ductility. Known commercially as Adaptaloy, this alloy contains 1.8 per cent copper, 1 per cent silicon, and 1 per cent manganese. It is particularly useful for castings that must be cold formed.

The demand for aluminum castings with higher strength at elevated temperatures has resulted in the introduction of alloy A140, which nominally contains 8 per cent copper, 6 per cent magnesium, and 0.5 per cent each of manganese and nickel. It contains small quantities of boron and titanium for grain refinement and beryllium for oxidation resistance. Permanent mold specimens tested at a temperature of 600° F, after heating at 600° F for 48 hours, show about 20,000 psi ten str, 15,000 psi yld str, and about 20 per cent elong. At temperatures of 400 to 600° F, the tensile and fatigue strengths of this alloy are superior to those of other commercial aluminum casting alloys, and its resistance to loss of high-temperature strength on prolonged heating is outstanding. Its most promising field of application is in aircraft engines, particularly gas turbine engines, and in missiles.

Advances In Production Methods—As in most industries, mechanization has increased considerably in aluminum foundries since 1953. Chief benefits of increased mechanization have been better productivity, lessened worker fatigue, and greater uniformity of product through reduction of foundry variables. Although mechanization has been more extensive in permanent molding and diecasting, notable strides also have been made in sand foundries.

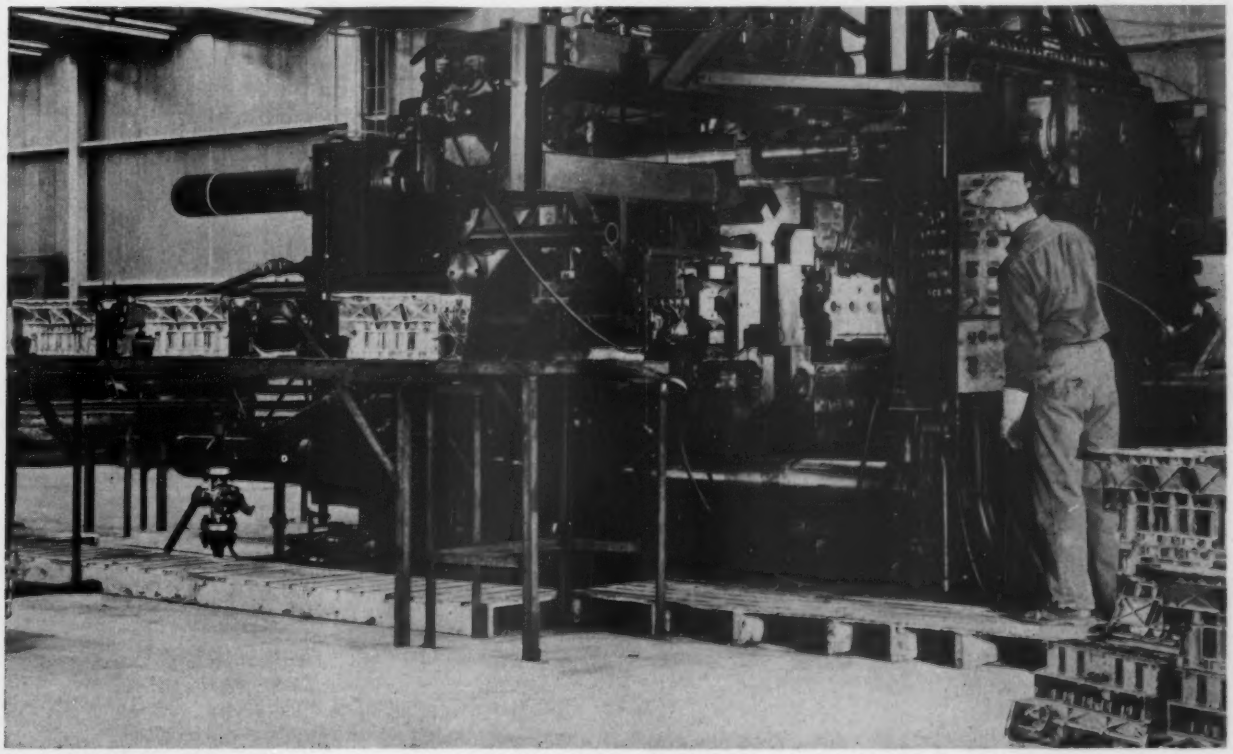
The majority of quality sand foundries now have thoroughly mechanized sand handling and conditioning equipment. Automatic control of moisture content of molding sand has become common in such foundries, reducing the number of defective molds produced. Synthetic sands have become more widely used, enabling sand foundries to produce castings with smoother surfaces than with natural sands. The greater uniformity of the synthetic sands also simplifies the preparation and conditioning processes.

Sand molding operations have become more highly mechanized, the degree dependent at least partially on the length of the production run. One foundry producing automotive castings has set up a sand casting line that is completely mechanized except for the setting of cores.

In this setup, drags and copes are molded at separate stations. The cores are set manually, the two mold halves are brought together via conveyors, and the molds are closed automatically and conveyed to an automatic pouring station. The metal is drawn off an induction melting furnace from below so that no dross goes into the holding furnace. Pouring is accomplished by air pressure applied to the surface of the metal for a controlled

Diecasting machines with high clamping pressures are used to turn out diecast automobile blocks. This one has a maximum clamping pressure of 2000 tons

Doehler-Jarvis Div., National Lead Co.



length of time to pour a predetermined amount of metal. Shakeout and sawing off of gates and sprues also are mechanized. A setup such as this is, of course, economical only for long production runs.

Perhaps one of the biggest changes in the sand foundry is the extensive use of shell cores to produce castings with smoother surfaces and closer dimensional tolerances than is possible with baked cores. Shell mold and core lines lend themselves to mechanization, and the introduction of fast-curing resins has greatly increased production rates.

Another significant development in aluminum sand foundries has been the increasing use of the CO_2 process for production of both molds and cores. Although plaster cores and molds have been used for many years, increasing demand for high-quality, close-tolerance castings of intricate design has brought some increase recently in their use.

Both permanent mold and die casting have increased in importance in recent years for at least two reasons. Both are basically mass production methods, well adapted to the production of automotive and other parts involving long runs. The other reason is that both methods produce the higher strengths, closer tolerances, and smoother surfaces demanded in aluminum castings today.

As in sand casting, the extent of mechanization in permanent molding and diecasting depends on the size and complexity of the parts being produced and the lengths of production runs. This is particularly true of permanent mold casting. For example, the larger permanent molds usually are opened and closed mechanically, either by air or hydraulic mechanisms, but many smaller ones still are hand operated. Complex molds involving intricate coring or loose pieces usually are operated at least partly by hand, regardless of size.

Automatic timing of the permanent mold cycle has become more common in recent years, and in some instances the entire operation is automatic, including the pouring of the metal. One such setup has the molds mounted on a turntable which positions the molds successively at the pouring station, where they are filled with metal from a continuous melting and holding furnace. After a predetermined time the molds open automatically and castings are ejected to be conveyed to the finishing room by an overhead monorail system.

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Core is being lowered into place in a mold which will be used to make a cast pump for a torque converter with a diameter of 27½ in.

The last seven years also saw the introduction of the low-pressure permanent mold process in this country. It is being used primarily in the production of engine castings for the Corvair automobile, but also to a limited extent for the pistons. In this process, the mold is mounted directly over a closed holding furnace. Metal is forced from the holding furnace up through a ceramic tube into the mold by air pressure (up to 10 psi) on the surface of the metal. One of the greatest advantages of this method is its high yield—up to 98 per cent of the metal cast. Because of the high equipment and setup costs, however, it is applicable economically only to high-volume production.

Usefulness of the semipermanent mold method has been broadened considerably through the use of shell and CO_2 cores, for these have the same advantages in permanent molds as in sand casting. Plaster cores also are being used to a limited extent in metal molds.

Diecasting operations have become even more mechanized during the last seven years. In some instances, the entire operation is automatic, including the pouring of the metal. In others, everything is automatic except that the metal is hand ladled.

Aluminum diecasting production today is almost entirely by means of the cold chamber machine. There has been a trend toward larger diecasting machines—with up to 2500 tons of locking pressure—so that this process could be used for larger and more complex castings.

The flexibility of the diecasting process has been improved materially by the increased use of holding die blocks with interchangeable insert cavities so that the same machine and die blocks can be used for many different parts. The use of multiple-cavity dies also has increased for parts requiring similar production runs.

Diecasters are making more ex-

tensive use of vacuum assist to remove air from the die cavity when the shot is made. This method reduces porosity and results in castings with higher strength and smoother surfaces. It also provides thinner sections to be cast at higher production rates, and because silicon-free alloys can be used, the resulting castings can be welded, brazed, anodized, or porcelain enameled.

Experimental application of sound waves and ultrasonic waves to the diecasting process is said to enable parts to be produced which previously were considered impossible by standard diecasting methods. A refined microstructure is produced in the cast metal so that castings have higher mechanical properties and better surface finish.

Metal handling improvements have contributed to production of better and more uniform castings and have aided in consistent realization of the higher properties obtainable from high-purity alloys. Actual handling of the molten metal has been reduced to limit absorption of gases and reduce the fluxing required. There has also been increased use of titanium, boron and zirconium as grain refiners.

In general, reverberatory and electric induction furnaces have increased in size. In many instances, pouring is done from the same furnace in which the metal is melted. A number of foundries are using continuous-type furnaces in which ingots are charged at one end and molten metal ladled from the other.

Quality Control — Quality control has continued to keep pace with other advances in aluminum castings. Increased demand for castings with higher mechanical properties and closer dimensional tolerances has meant generally tighter quality controls, including broader use of statistical methods.

Introduction of the high-purity alloys has required closer composition control. The direct-reading spectrograph is becoming popular because it gives a complete analysis in only a few minutes so that any necessary corrective measures can be taken before the metal is cast.

Increasing mechanization has required quality control programs to spot trouble as soon as it occurs to avoid the production of a large volume of defective castings before the trouble can be remedied. This move has resulted primarily in a speedup of existing methods of production testing, rather than in the introduction of new methods.

Although x-ray and ultraviolet inspection have been used for many years to reveal internal and surface irregularities, their use has broadened in recent years, and more castings now are receiving 100 per cent inspection by these methods. These methods also are being used more widely in developmental stages. The application of x-ray inspection has been aided considerably by issuance of a set of standard radiographs under the title "Tentative Reference Radiographs for Inspection of Aluminum and Magnesium Castings" by the American Society for Testing Materials (E155-60T).

There have been essentially no changes in mechanical testing methods since 1953, but an increasing number of specifications are calling for guaranteed mechanical properties in the castings themselves rather than as measured by separately cast test bars. Specified properties sometimes must be met by test specimens cut from specified portions of the castings, in others by specimens from any part of the castings. The increased production of aluminum castings requiring pressure tightness naturally has meant an increase in pressure testing.

Conclusion — In summary, the producers of aluminum castings are meeting users' demands for improved casting quality through the introduction of improved alloys, mechanization, improved foundry methods, tighter quality control procedures, and continuing research.

In addition, the trend toward collaboration between the foundry's engineers and the user's designers is becoming more important as a means to take advantage of aluminum's unique combination of properties in castings.

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Coremaker is placing a hardened CO_2 core from a rollover machine onto a skid for transportation to core assembly and molding operations

Aluminum Co. of America

Malleable Iron Castings

. . . usage has expanded in some fields as a result of advances in research, development, and marketing. Continued growth is seen

By HANS J. HEINE
Technical Director
Malleable Founders Society
Cleveland

● A HIGH LEVEL of basic or applied research is fundamental to the foundry industry's advancement and economic growth. Design, production, and application techniques, through which scientific discoveries are transformed for the use and service of the people, depend on basic research.

The last eight years have witnessed great strides by the malleable foundry industry. Advances in research, development, and marketing have pushed the several grades of malleable irons into the metalcasting limelight.

Since 1953, numerous research programs have been initiated by the malleable iron industry to gain fundamental knowledge relating to this important ferrous alloy. Much of the work has been directed by the Malleable Founders Society, through investigations at engineering colleges and private research organizations. Additional information has been added through cooperative feasibility studies with member companies.

The research programs undertaken can be divided into two categories: Those designed to yield immediate product improvement and operational economies, and those carried out on a long-range basis for the purpose of developing basic knowledge on the material and methods of producing it. The society-sponsored and co-operative research programs have been vigorously supplemented by the technical activities of the Malleable Iron Division of the American Foundrymen's Society and the Malleable Research and Development Foundation. This last-mentioned organization was incorporated in 1956 and is currently administering an ambitious research and development program for its member companies.

Fields of Research—Malleable research in recent years includes: An exhaustive study of the effect of various atmospheres in melting and annealing; a fundamental study of the thermodynamic properties of Fe-C-Si and Fe-C-Mn systems; an evaluation of the elevated temperature properties of ferritic, pearlitic, and alloy malleable irons; a comprehensive study of the gating and risering of malleable castings, and a machining project, the first phase of which was completed in January of this year.

These programs have made significant contributions to the understanding of malleable iron production and control, and this knowledge is vital in today's highly competitive cast metals market. Although the past eight years have shown a gradual decline in the relative positions held by competitive cast materials in the ferrous metals market, use of malleable iron castings is on the rise.

This is due, in part, to an extensive advertising and product development campaign directed by the Malleable Castings Council, which has focused the attention of designers and potential users on the advantages of specifying the malleable irons. A more important factor in the rise of malleable usage is the increasing employment of pearlitic malleable irons. This advance by pearlitic malleable is depicted in Fig. 1, which covers the period from 1945 through 1960. In 1950, this material represented 6 per cent of the malleable industry's volume; today it accounts for well over 20 per cent.

Malleable iron castings are used in virtually every branch of American industry, the largest tonnage normally being consumed by the automotive companies. The railroad, agricultural implement, electrical pole line hardware, pipe fittings, and detachable chain industries are other major users of ferritic, pearlitic, and alloy malleable

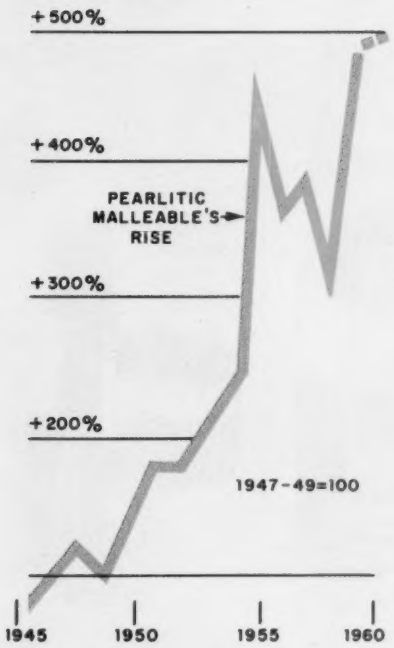


Fig. 1—Tonnage sales of pearlitic malleable castings are up 500 per cent over 1947-49 base

Fig. 2—Ferritic malleable iron bearing block, weighing 45.5 lb, is used on heavy-duty tractor

iron castings in their products.

The castings used are made in a size range from a fraction of an ounce to several hundred pounds and from ⅛ in. to several inches in section thickness. A research program is currently under way to extend the upper limit of section thickness. Incomplete results developed to date are encouraging.

Strength Increases — Mechanical properties of pearlitic malleable iron have been improved in recent years through research and development work. For instance, ASTM specification A 220-55T for grade 80002 pearlitic malleable calls for 100,000 psi tensile strength, 80,000 psi yield strength, and 2 per cent elongation in 2 in. This will not be the upper limit for long, because in recent experimental work tensile strengths over 120,000 psi and yield strengths in excess of 100,000 psi have been obtained.

The ferritic malleable irons, grades 32510 and 35018, have good strength, a high ratio of yield to tensile strength, and excellent ductility as measured by the per cent elongation. Castability, toughness, good fatigue strength, and excellent machinability make standard malleable iron an ideal material for many automotive, agricultural implement, railroad, and general industry applications.

The seven grades of pearlitic malleable iron offer a wide range of strength values to the designer. For components requiring wear resistance, high hardness, hardenability, and high strength, pearlitic

Fig. 3—Shotgun frame, converted to pearlitic malleable at substantial cost reduction, has fine surface appearance

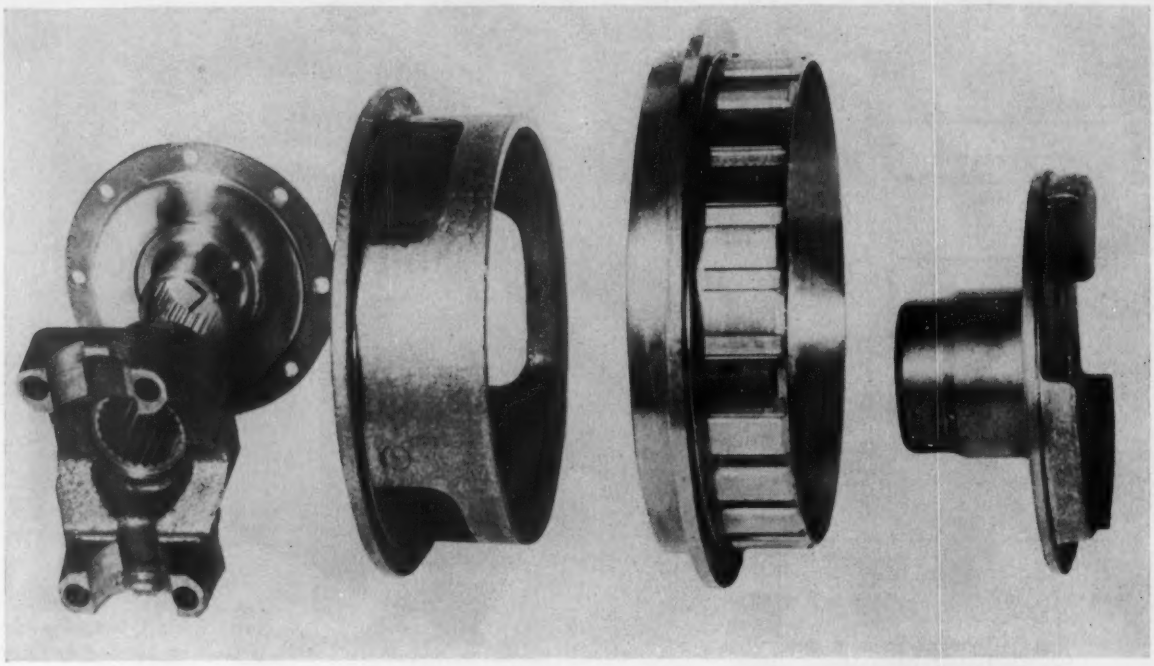


Fig. 4—Malleable iron parts in this automotive transaxle are, left to right, universal joint yokes and torque turbine hub in the assembly, planet carrier, reverse ring gear, output shaft, and the two selector forks at extreme right

malleables are ideally suited. These advantages are accompanied by a high modulus of elasticity (28 million psi) while castability, toughness, and machinability are retained.

Typical applications of ferritic and pearlitic malleable iron castings are shown in Fig. 2 and 3. Fig. 2, is a ferritic malleable bearing block. This component is used for a heavy-duty tractor and provides an oil-tight compartment for a sealed-in bearing.

The shotgun frame shown in Fig. 3 is a pearlitic malleable casting. The part was originally a steel forging; conversion to malleable resulted in substantial cost reductions accompanied by an excellent surface appearance of the finished part.

Malleable iron castings have found widespread usage in the compact cars. An average of 80 lb of malleable was used in the 1960 models. Some 1961 models have over 90 lb. A ferritic malleable iron differential carrier into which tubular steel extensions are pressed and welded is used on one compact. The transaxle (Fig. 4) used on another compact, employs six malleable castings. Pearlitic malleable iron was selected for this application because of its good bearing properties, machinability, and cost advantages.

In addition to these compact car parts, the standard size cars use an average of 100 lb of malleable. Typical components include rocker arms, universal joint yokes, crankshafts, door hinges, sprockets, housings, and many others.

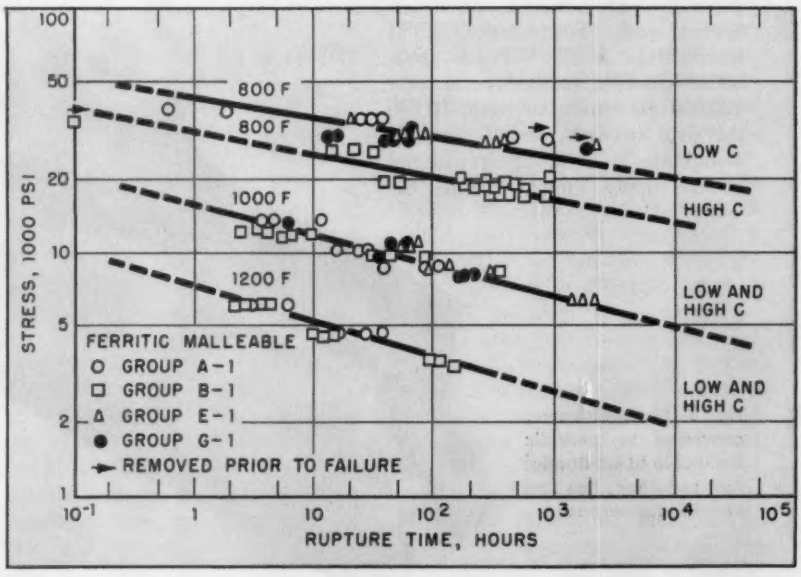
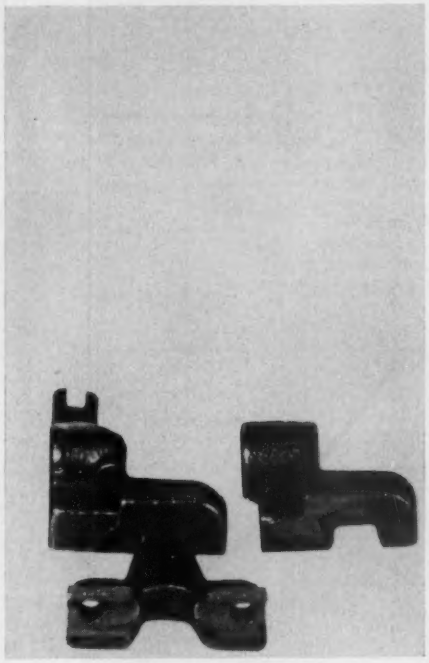


Fig. 5—Stress-rupture data are plotted for standard malleable iron at 800, 1000, and 1200°F



New Hardening Process—As indicated above, numerous applications requiring wear resistance precluded the use of ferritic malleable iron in the past. A new soft-nitriding process for hardening finish-machined parts, originally developed in Germany, recently was introduced in this country and was investigated by the Malleable Founders Society. Results of this study indicate that wear resistance can be increased by a factor of 10, and fatigue strength can be increased upwards of 30 per cent. These improvements should expand the use of ferritic malleable iron in many applications.

When the requirements call for high strength along with wear resistance, the pearlitic malleables should be specified since these materials are inherently stronger and more wear-resistant. In addition, the pearlitic irons show excellent response to localized or through-hardening and have hardenability characteristics similar to those of AISI 1340, 4045, and other alloy steels. A hardness of Rockwell C 50 is readily obtainable on sections 1 in. or less in thickness.

Research Work — New applications for malleable iron components are being developed continually. As a result of the elevated temperature research program completed in 1959, a new specification covering the use of malleable iron castings at temperatures up to 1200° F, will be approved and issued by ASTM. Fig. 5 and 6 are stress-rupture plots for ferritic and pearlitic malleables, respectively.

These curves point out one very significant fact: The strength of malleable iron decreases at a uniform, gradual rate with increase in temperature, because no graphitization takes place and no abrupt decrease in rupture strength is indicated. Additional tests on manganese-molybdenum alloyed pearlitic malleable irons indicate a considerably higher rupture strength at elevated temperatures than that found in unalloyed irons, which suggests additional high temperature applications.

Alloyed malleable irons constitute the third member of the malleable iron family. The two principal grades are the copper- and copper-molybdenum-ferritic malleable irons. The alloy additions increase yield and tensile strength, fatigue strength, and resistance to corrosion. Typical mechanical properties for a copper-molybdenum-alloyed malleable iron are as follows:

Tensile strength ..	58,000-60,000 psi
Yield strength	40,000-45,000 psi
Elongation	15-20% in 2 in.
Brinell hardness .	135-155

Machinability — Malleable iron has long been recognized as being one of the most machinable ferrous metals in its range of properties and for the particular microstructure exhibited. In an effort to obtain authoritative data to substantiate this claim and to secure additional economies for the users of malleable iron components, the Malleable Founders Society recently studied the turning characteristics of this metal.

Curves relating tool life to cutting speed, using parameters of feed, depth of cut, tool geometry, surface finish, and cutting fluid, have been secured for both ferritic and pearlitic malleable irons as well as for competitive alloys. Fig. 7 presents typical data on turning four grades of malleable iron for under-skin finish cuts.

For these tests, a depth of cut of 0.010 in., a feed rate of 0.007 in., and a soluble cutting fluid were used. As can be seen, for a tool life of 20 minutes, a cutting speed of 1400 ft/min can be used when turning Grade 32510 ferritic malleable, 600 ft/min for 48004 pearlitic, 500 ft/min for 60003, and 375 ft/min for Grade 80002.

Other conclusions which were

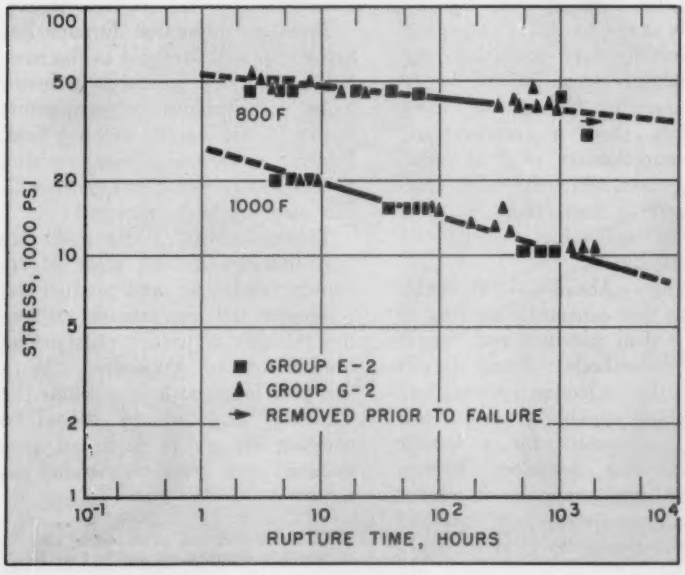


Fig. 6—Stress-rupture data are plotted for pearlitic malleable iron at 800 and 1000°F

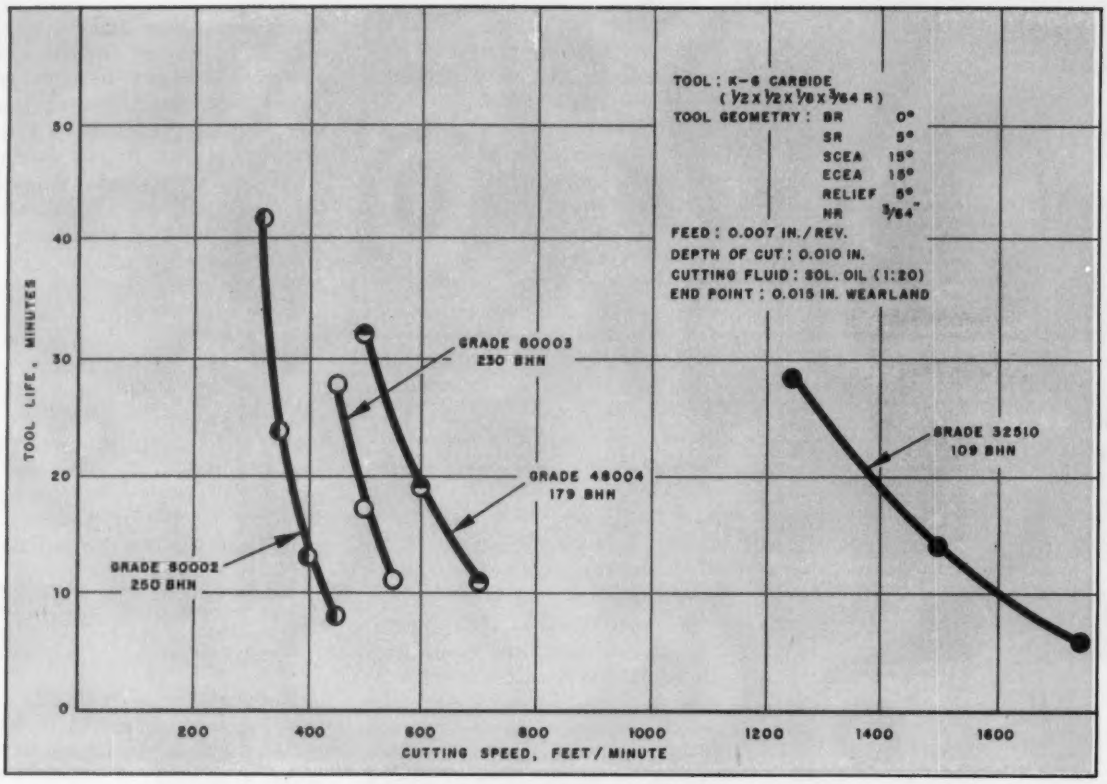


Fig. 7—Typical data on the turning of four grades of malleable iron (under skin finish cuts) are plotted here, relating tool life to cutting speed

drawn from this program are summarized below:

1. Cutting speed can be increased from 10 to 50 per cent in certain turning operations when a soluble oil cutting fluid is employed as opposed to dry cutting.

2. Production rates are increased substantially when the feed rate is increased to the maximum permissible value consistent with machine tool and part requirements.

3. For under-skin coarse cuts at high feed rates, negative rake tools are far superior to positive rake tools.

4. At high feed rates, a tool nose radius of 1/16 in., as compared with a 3/64-in. NR, greatly improves surface finish.

5. Cutting speed is a more critical variable when high feed rates are used as compared with low feed rates.

Coining and Costs—Fig. 8 shows two malleable cast parts used in an automotive automatic transmission. Both parts formerly were steel forgings and required three machining operations. Now, drilling the shaft hole in the top part is the only metal removal necessary. The inherent ductility of malleable irons permits many parts to be coined in place of machining with resultant cost saving.

In a study forming the basis for the thesis of a Purdue University student, the costs of manufacturing a simple shape by different production methods were compared. Fig. 9 summarizes some of the results of a survey of 250 manufacturers. The data show a comparatively rapid amortization of malleable's start-up costs, while the other processes were at least three times as costly as malleable castings for small quantities.

Looking Ahead — Malleable foundries are constantly striving to improve their product and manufacturing methods. Many factors govern the selection of modern short-cycle annealing and heat treating equipment for a specific malleable iron operation. Several foundries use automatic combination heat treating plants with atmosphere control to produce high-strength pearlitic grade castings.

Electrically-heated roller hearth conveyor or batch elevator furnaces are becoming increasingly popular. Use of this equipment may eliminate the need to pack castings, resulting in the shortest possible annealing cycle and efficient over-all operation.

Since the induction furnace has become so well accepted in the nonferrous foundry field, our industry looks with interest to comparable results in the ferrous melting field. Interest in electric furnace melting is increasing, and developments in this area are to be expected.

The endeavors of the malleable iron industry in the areas of research, marketing, and product development will increase the utilization of this material's outstanding combination of properties. With this goal foremost in our minds the malleable iron industry should be entering an era of increased productivity and greatly expanded activities.

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Fig. 8—Hot coining of these pearlitic malleable auto transmission castings brings them to finished dimension and reduces machining

Fig. 10—Railroad car manufacturers are extensive users of malleable castings. The brake beam parts illustrated below are typical examples

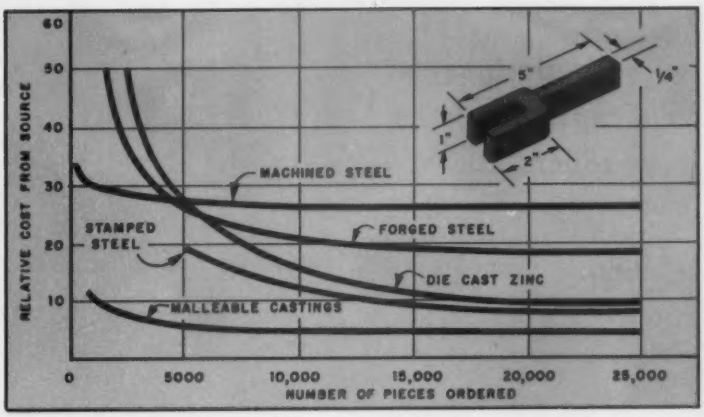
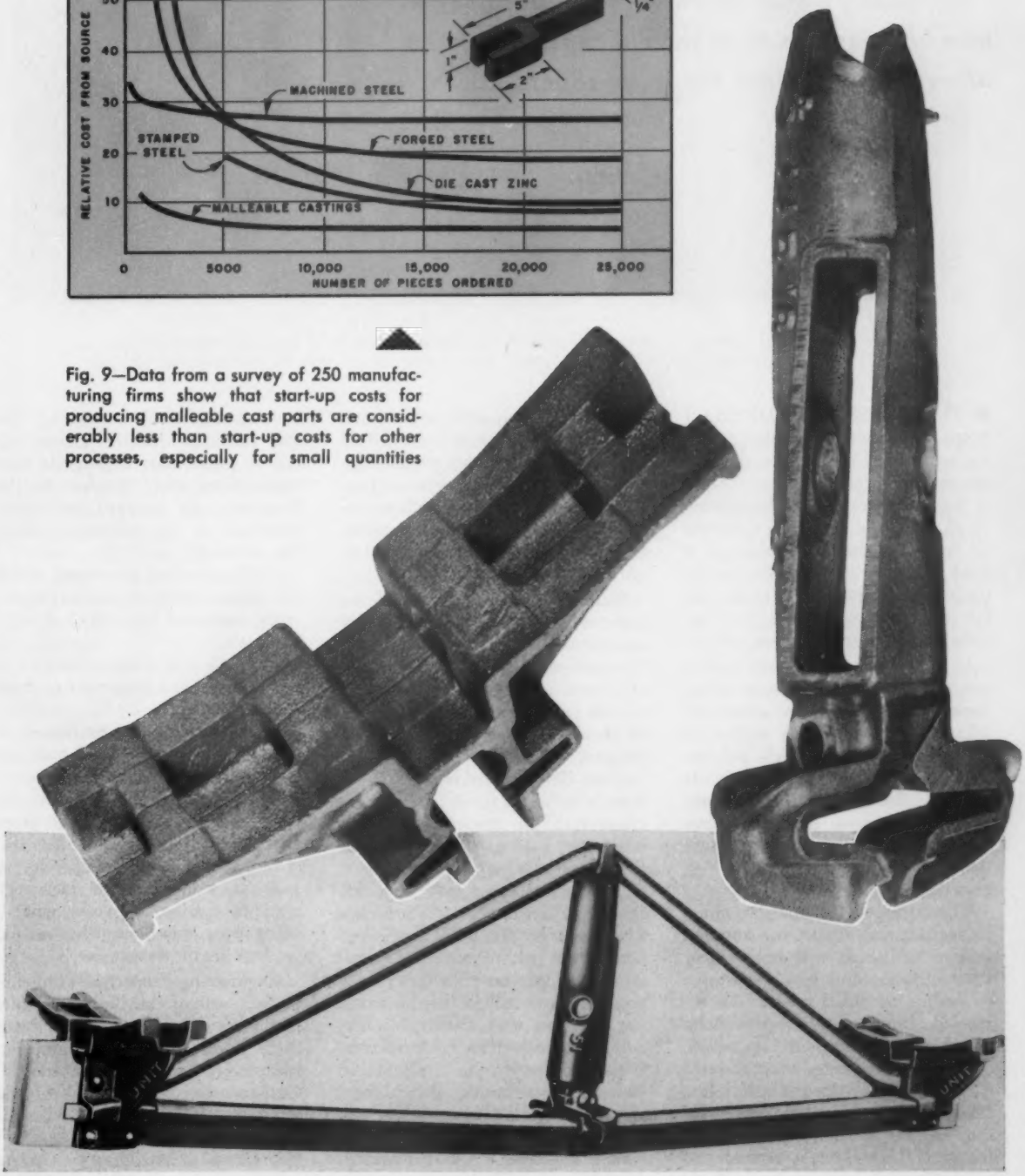


Fig. 9—Data from a survey of 250 manufacturing firms show that start-up costs for producing malleable cast parts are considerably less than start-up costs for other processes, especially for small quantities



Brass and Bronze Castings

. . . industry must work with the designer of new components to achieve a consistent influx of new applications for its products

By RICHARD A. FLINN
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and
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Non-Ferrous Founders' Society

● THE BRASS FOUNDRYMAN is one of the world's hardest working people, and his product, the copper-base alloy casting, is made of one of the most durable and dependable of all materials. It is hard indeed to reconcile these elements of a good business with the decline in copper alloy tonnage during the last ten years while the gross national product grew 75 per cent.

It is not enough to point to the cost of copper as a reason when during the same period aluminum alloys have made large strides in replacing materials which sell for a much lower cost per pound. It appears, then, that the problem calls not for more hard work, but for more hard thought to answer the question "What leads to growth?"

The first point is that we must be realistic and expect the tonnage from established, mature applications of brass and bronze castings to decline on the average. Therefore the influx of new applications or of improvements in the older ones must be greater than the decline rate. The importance of this infusion of new applications, even if it is only a small percentage of the annual total, has a twofold importance. Simple arithmetic shows that a conservative net growth of 4½ per cent per year would double the tonnage in 17 years. Furthermore, a newer application usually involves higher quality material which yields higher profit margins.

Birth of an Application—If we grant the importance of the new application, where does it originate? The potential casting is conceived as a new component in the mind of the project engineer and comes to life on the drawing board of the designer.

Once the designer has a component in mind, he turns to search for alloys with the proper engineering properties, such as strength, toughness, conductivity, corrosion resistance, and appearance. Next, his choice is narrowed to materials which can be produced in the desired shape with the needed properties. Third, he cuts the list of possible alloys still further by crossing out those with which he is unfamiliar or in which he lacks confidence. Finally, in conjunction with the purchasing department, the final decision is made on the basis of service, quality, and cost.

Four Factors—We may summarize this sequence by selecting the four factors which will govern the use of copper-base castings in new applications and thereby, in the long run, the tonnage and profit potential of the industry. These are as follow:

1. Engineering properties which are offered and produced consistently, compared with those of other materials.
2. Variety of shapes available as castings and the properties of those shapes.
3. Knowledge and confidence of the users (the designer and the project engineer) in these shapes.
4. Competitive rating of the finished product with the price properly weighted by performance.

In each of these groups, let us look at what progress has been made in the last few years, what is being done now, and what should be done in the future.

Engineering Properties—This important section can be divided into five parts: 1. Chemical analyses. 2. Physical properties at ambient, low, and elevated temperatures. 3. Corrosion resistance. 4. Wear and abrasion resistance. 5. Machinability and weldability.

1. *Chemical Analyses* — One of

By the development of proper thermal gradients in a casting, properties can be produced in it which are better than those indicated in the test bars

the handicaps of the industry has been the large number of different analyses in use. Foundrymen, consumers, and ingot manufacturers have worked diligently at this problem from 1929, when 600 different alloys were in use, to the present, when the list contains about 40 ASTM, SAE, and other alloys in common use.

A great deal of this good work was accomplished by elimination of conflicting or duplicating chemical analyses. With the active co-operation of organizations of ingot producers such as the Brass and Bronze Ingot Institute, a higher standard of accuracy and reproducibility of analysis has been attained in the final casting.

It may, however, be time for a new look. We soon may be able to simplify the list still further by concerted application of principles which are being developed in both basic physical and process metallurgy.

Despite the wide number of analyses, we really have only two simple types of alloys—the single-phase with moderate strength and high ductility and the two-phase, precipitation-strengthened type, both with the possibility of variation in lead content for machinability. It does not seem that 40 different analyses are needed to attain this variation in properties. We might do better to specialize in the alloys with best castability, as will be discussed later.

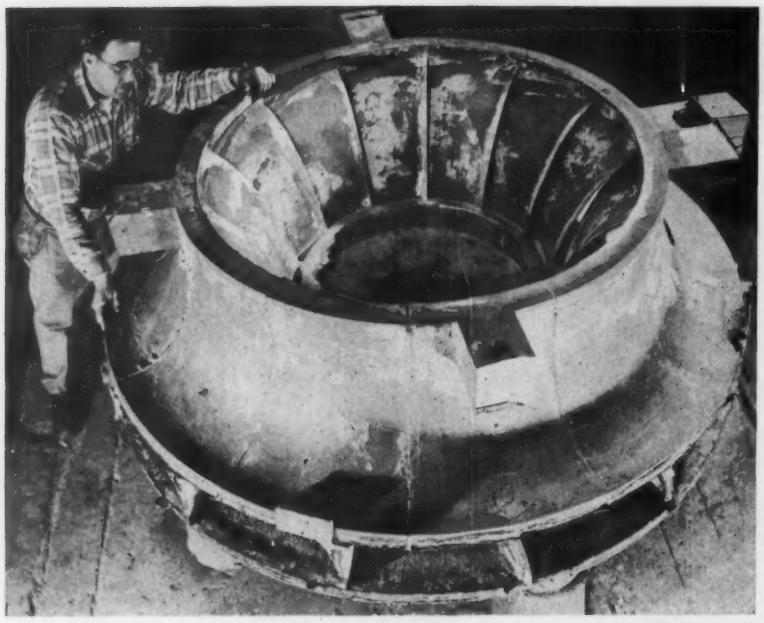
3. *Physical properties*—Examination of the specifications shows that most alloys can be placed in one of two groups: 1. Single-phase alloys with tensile strength of 34-44,000 psi, yield strength of 15-22,000 psi, and elongation over 20 per cent. 2. Precipitation-strengthened alloys with 60-120,000-psi tensile strength, 25-80,000-psi yield strength, and from 10-40 per cent elongation, depending on the amount and nature of the precipitate. The beryllium bronzes are a special case, with tensile strengths up to 166,000 psi, 150,000 psi yield strength, and 2 per cent elongation.

In many of these systems, excellent basic work has been done by physical metallurgists and physicists working with wrought materials. These investigations have dealt with the nature and control of the precipitate, in the aluminum bronzes and beryllium bronze.

It is indeed remarkable, however, in view of the high cost and possible scarcity of beryllium that other precipitation-strengthened alloys of equivalent properties have not been developed. A cast alloy is free from many of the compositional restrictions of wrought materials, and further research in this field is needed to develop alloys of modest cost with a high strength-to-weight ratio.

The excellent properties of copper-base alloys at low temperatures in the rapidly expanding field of cryogenics (low-temperature applications) have received only scant attention. Many common alloys (basically those with a body-centered cubic or hexagonal closely packed structure) become embrittled at lower temperatures. For most copper-base alloys, however, an increase in ductility and strength takes place in most instances as the temperature is lowered to within even a few degrees of absolute zero (−460° F).

The list of equipment in which behavior at low temperatures is important includes[1] aircraft (average temperature at 35,000 ft, −70° F); petroleum refining (dewaxing); freeze drying of blood plasma; liquefaction of chlorine; sulfur dioxide dewaxing; purification of nitrous



Properties of aluminum bronze castings should lead to their wide application whenever toughness, strength, and wear resistance are necessary

oxide; "cold treatment" of tool steel; butyl rubber production; liquefaction of natural gas; manufacture of liquid air; and extraction of helium from natural gas.

All of these applications are below the ductile to brittle transition temperatures for materials which become embrittled.

The field of moderately elevated temperatures should be a fertile one for copper alloys, particularly in the range above the limit of usefulness of other alloys. More data are needed about the heat-resistant alloys such as the aluminum bronzes, if they are to be used to full potential.

The high thermal and electrical conductivity of copper is the basic reason for its application in many cases. Important advances have been made in developing high-strength, high-conductivity alloys in the wrought materials such as zirconium copper, and these should be followed aggressively for cast alloys. Much good work has been done recently dealing with the deoxidation of copper with lithium and other materials.

The color of the copper-base alloys is one of their outstanding physical properties, but the least exploited. The market for consumer items of copper, bronze, and brass color could be an extremely important one.

3. *Corrosion Resistance*—To be really corrosion-resistant, an alloy either must be thermodynamically immune to reaction in a given environment or must build up a passive film. Gold in water is an example of the former, and aluminum in water is a case of the latter. Copper alloys, however, utilize both mechanisms.

Copper is unreactive with pure water, but when more corrosive conditions are present, as in an industrial atmosphere, the familiar and attractive green patina, which is a complex carbonate film, develops. The low solution potential of copper, even in the active state, has led to its use in marine and outdoor applications.

Although these facts have been exploited by wrought copper producers, who are making great strides in the field of piping and tubing, there has not been a proportionate increase in the use of copper castings.

4. *Wear and Abrasion*—In the area of wear and abrasion, manufacturers have not taken advantage of the possibility of controlling the amount and dispersion of the lead particles. Nor has the role of the lead in severe wear conditions involving boundary lubrication or abrasive particles been fully developed.

There is a great scarcity of good quantitative information here. Copper alloy bearings have been standard for years in many machine parts, but have lost much ground to other bearing materials. A concerted study of the nature of bearing wear and standardization of a few of the more wear-resistant alloys would be highly desirable. An important step in growth in this field using existing information has been the publication of the *Cast Bronze Bearing Design Manual* by the Cast Bronze Bearing Institute.

Another field in which toughness and resistance to wear is important is in rolling mill "slippers." It is hard to understand how the outstanding performance of aluminum bronze in this part has not led to wide application in other fields in which this combination of toughness, strength, and wear resistance is needed.

5. *Machinability and Weldability*—The excellent machinability of the leaded bronzes and brasses is grounded on the unique fact that lead is soluble in liquid copper in any amount above 2100° F. Since lead is practically insoluble in solid copper, an ideal spherical precipitate of soft lead particles develops, provided that the lead content is not excessive. These particles of spherical shape do not lower strength significantly when present in amounts needed for machinability.

Here we have a great basic advantage in the copper-base alloys since lead is not soluble in other common alloys and less satisfactory, mechanical dispersion methods must be used. To take full advantage of the lead phase, research is needed to determine the optimum amount and the particle size for best machinability under varying conditions.

The weldability of copper-base castings is good in general because of the absence of embrittling phase transformations during cooling and because of the high ductility of most alloys. A thorough appreciation of the differences in welding behavior due to the effect of alloying elements on the melting range is needed, however, to guide the designer and fabricator. It should be realized that copper castings are

widely used in electrical applications because of their excellent brazing and soldering characteristics.

Cast Shapes and Their Properties — The brass foundryman has worked diligently to apply newer foundry techniques such as shell molding, CO_2 process sand, and organically bonded green sand to his problems. Probably the two fields in which greater effort is indicated are the control of casting surfaces and dimensions and further study of automated processes such as die and low pressure permanent mold casting.

Because of the general low reactivity of copper-base alloys, the amount of metal-refractory interaction is minor, and casting surfaces should be correspondingly good. A good deal remains to be done to reduce the incidence of simple defects such as penetration and dross by applying some of the gating and molding techniques which have been developed for other alloys.

Greater Use of Metal Molds

Permanent molding and diecasting, which are easily controlled and automated, seem certain to find greater use. A solution to the old problem of erosion of the permanent mold seems more likely today in view of the successful casting of steel at much higher temperatures.[2]

One of the important advances of the recent period has been the greater use of graphite molds to produce high-quality centrifugally cast bearings, bushings, and gear blanks.

In the field of the engineering properties of castings, too little work has been done. When asked about the properties of a casting, foundrymen usually have retreated to the test bar specification and then added, "Just leave the problem of making a sound casting to us." Aircraft designers have been the first to break down this ostrich-like attitude, with the reply, "We fly the castings, not the test bars." The foundryman is entitled to want to test the quality of a melt with a test bar, but this step does not provide information as to the engineering properties of the casting.

When strength and ductility are important factors in high-production castings, the strength of the casting at critical locations should be determined. Part of the desire to keep the properties of a casting in the background has been the fact that in the past they have been lower than those of the test bar. By development of proper thermal gradients in a casting, however, properties can be produced at better than test bar levels.[3, 4]

Alloys differ greatly, however, in the chilling needed to promote this soundness.[4] Recent work indicates that it is possible to cast even some of the long-freezing-range alloys with satisfactory soundness. Further work along these lines should be done to determine or develop the most castable compositions. When this goal has been accomplished, the consumer, the producer, and ingot makers should review the existing specifications.

Cast Shapes and Their Users—In general, the foundryman is at a severe loss where the designer's and the project engineer's knowledge of cast shapes and their confidence in them are concerned. One of the valuable aspects of the foundry industry—the wide distribution of sources and the resulting keen competition—operates against him because these smaller units are not effectively represented. Many engineers even cross off casting as a method of production because they have been at the mercy of a purchasing system which has bought low-quality, low-priced castings which have failed in service.

It is time for the reputable producer to present his case to the engineer and to point out that he can compete only with other foundries offering comparable quality. If the engineer then will insist on qualification of sources, he will be able to count on proper standards of quality. For the foundryman's part, if he wishes to compete with wrought products, he must not retreat when faced with internal defects uncovered by machining under cover of the argument that, after all, he isn't producing screw machine stock.

The educational need in this area is vast. As an engineering student or graduate engineer looks at the glamorous lists of free technical literature available concerning other materials, he finds that the amount of literature about copper alloy castings is very scanty. We are not building up the knowledge and confidence of the user at a fraction of the rate of the producers of other materials. A handbook entitled *The Nature, Properties, and Applications of Copper, Brass, and Bronze Castings* is being written by the Non-Ferrous Founders' Society in an effort to fill this void.

Competitive Rating of the Finished Product—The fluctuation in copper prices and the generally advancing price of copper (until recently) has led the foundryman to blame this factor for his reduced market. One of the methods of stabilizing prices and profits is the use of LIFO (last in, first out inventory). In any event, a recent completely objective survey by the Non-Ferrous Founders' Society disclosed that only a small fraction of consumers consider selling price the most important factor in alloy selection.

The foundryman should take the lead in educating the user to calculate the real value of his castings in place of the selling price. Such an analysis would take into account factors such as cost per hour of service, scrap value, safety, appearance, and efficiency of performance.

Conclusion—It would not have been proper to attempt a glowing review of progress, replete with success stories, for this summary. It should be noted, however, that some foundries have progressed against the tide by applying many of the elements of growth we have just discussed, and they are to be congratulated.

This summary has been prepared more for the foundries which have not advanced in the hope that some of these suggestions may inspire them to fresh thought. For we firmly believe that it is only by the proper amount of concern with the new application, coupled with constant improvement of the old, that the brass and bronze casting industry can reach its proper place in the nation's economy.

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Meeting Competition Through Improved

FOUNDRY TECHNOLOGY

Gray Iron Castings

. . . production has not kept up with growth of the national economy since 1955. Design engineers are key to the industry's progress

By CHARLES F. WALTON
Technical Director
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Cleveland

● IN MAY, 1953, FOUNDRY published an article by the late Charles O. Burgess, then technical director of the Gray Iron Founders' Society, which reviewed new technical and operating developments in the industry at that time.

Mr. Burgess stated, "The volume of castings has increased in accordance with the national industrial expansion the last six years, and percentage-wise has equaled, and in some years exceeded, the growth in rolled steel capacity of the country." After exploring the then recent technological advances and prospects, he concluded, "Clearly there is reason for great optimism as concerns the gray iron industry as a whole."

Growth Has Stopped—Unfortunately, technology was not enough to sustain his prediction. Since 1955 the growth of gray iron production not only has stopped, but has started a slightly downward trend in the face of a continuing increase in our gross national product. As this country's economy continued to rise to new and greater heights, the iron foundry industry lost its forward momentum. While economists debate whether our nation's total industrial growth should point upward at a rate of 5 per cent annually rather than 2½ per cent, our industry is pointed downward.

What has happened since 1955 to cause this change? With all the new technology that Mr. Burgess discussed, why haven't we continued to prosper?

Actually, technological progress has continued at an impressive rate. Suppliers have provided us with new and better binders for molding and core sands; foundry equipment manufacturers have developed faster and better machines for molding, coremaking and cleaning; and foundry operators have employed all of their ingenuity to utilize fully the equipment and methods available to them.

There is sound evidence of their efficiency and innovation in the U.S. Department of Commerce and Bureau of Labor statistics. Over the past decade, inflation has caused a steady rise in the price of virtually all commodities; but while the cost of rolled steel products increased 86 per cent and aluminum ingot increased 76 per cent, iron castings averaged only a 59 per cent increase in cost. Thus iron castings are relatively a much better bargain than they were ten years ago.

In addition, this situation was accompanied by a remarkable increase in casting quality. Castings shipped a decade ago could not compare in accuracy and properties with today's castings. Our customers now insist on both higher quality and a lower percent of defectives. "AQL" and other statistical quality control terms now are in everyday use by modern production foundries. Gray iron castings commonly are specified in higher strength grades that were available from only a minority of foundries a decade ago.

The industry certainly is aware of the many technical and operating problems it still has to solve, and most foundrymen know that an adequate industry research program would accelerate our progress. No one well acquainted with the iron foundry industry, however, could deny the extent of its technical proggress. Lack of progress therefore can not be laid to a slowdown of technology.

From a historical standpoint, it can be said that in our nation's industrial revolution, the casting process was the first mass production method for metal parts. As other methods of manufacture were perfected and new materials were developed enough to be economically practical, it was natural that the market dominated by the original product had to be shared.

If the growth of the total market continued at a more rapid pace than that of the new materials, however, the original product also could continue to increase in production. This condition applied for gray iron castings until 1955. Since then, components made by the newer methods and of newer materials have grown more rapidly than the

Continuing growth of ductile iron applications is one of the bright spots in the gray iron industry. View above shows ductile iron being processed

total market, leaving less business for gray iron foundries.

Some understanding as to why this change has taken place may be gained by considering who buys iron castings and for what purpose. The United States Department of Commerce has five classifications for gray iron production: Ingot Molds, Railroad Car Wheels, Pressure Pipe, Soil Pipe, and Miscellaneous Gray Iron Castings. Of these, the last is the most important in both tonnage and value. The other classifications are by no means unimportant, but they are affected by conditions specific to each product and not in common with the others.

Castings under the Miscellaneous classification are mainly component parts of automobiles, electric motors, pumps, construction equipment, and machinery of all kinds. These components are made of iron castings because the designer designated that material.

Designer Is Key — Gray Iron Founders' Society, Richard Meloy, marketing director, continually reminds us that virtually every casting starts on someone's drawing board. The designer is influenced in his work by his education, his experience, and advice from others. If he was educated before World War II, it is most likely that he knows what a casting is from first-hand experience. Most engineering schools then had a required foundry course. Many of the high schools in industrial communities had a foundry, and some even included a cupola. In mechanical drawing there inevitably were class problems based on castings, and often pattern drawings had to be made. The apprentice draftsman put in his required time in the pattern shop and sometimes even in the foundry. With such a background, the designer moved into a position of authority over material decisions without being a stranger to iron castings.

In contrast, consider the education of technicians and engineers today. In many schools there are no required courses in either foundry or pattern shop, and some schools have dispensed with shop courses altogether. Even machine shop classes are being eliminated to provide adequate time for the basic science courses in mathematics, physics and chemistry which now are considered essential to engineering or scientific education.

While in school and afterward, the designer or engineer also is influenced by technical magazine articles he reads, speakers at engineering meetings he attends, and even by what he reads in newspaper and magazine ads. It is not likely that he will encounter sufficient data about iron castings in any of these places. (Unfortunately, not enough design engineers read FOUNDRY!)

Our industry has, in the past, had its share of magazine articles about its products. When GIFS was preparing its handbook, thousands of dollars were spent to collect data for the chapter on casting design. The information was released to *Machine Design* and was used for a cover picture and 19 editorial pages in the January, 1957, issue. This presentation was one of the most popular items the magazine had published, and it attracted thousands of requests for reprints.

Not Enough — Successful stories like this one require research work, however, and our industry is doing virtually no research of interest to its customers. A look at the lists of papers presented at the last several AFS Congresses quickly discloses the shortage of constructive work on the properties, design, or uses of gray iron castings. Gray iron foundrymen look to AFS for technical leadership and research, but it can not finance much research with $20 annual dues. Most societies require more than this just to run their organizations. This job, like many of the other responsibilities in a free society, is left by the majority for the minority of "Georges" to do.

When a designer inexperienced with the casting process must design a part, it is much easier for him to visualize the welding together of standard shapes (quickly found in his wrought steel handbook) than to become confused by parting lines, draft, core prints, etc. Even if he was convinced that the part should be cast, he could not find a book that would tell him clearly and fully how to design a casting. It is likely that he might not even have a modern reference to the properties that are available in gray irons and ductile irons.

The *Gray Iron Castings Handbook* published by the Society in 1958 still is in its first printing of 10,000 copies, and there are many times more designers or engineering offices than that. It is even easier to turn the project over to a weld fabricator, forging shop, or plastic molder who will gladly design the part for him as well as produce it!

If he decides to stick to it, however, and work the problem out as a casting, eventually he may get to the point of seeking an iron foundry to help him with his design. What is the possibility that the foundry he contacts will be willing or able to help with casting design? How many of our 2000 iron foundries offer a casting design service or even can help designers with specifications?

Foundries Must Aid — Many foundrymen say that this assistance is not their business. They are in the business of making castings, not giving away or even selling engineering service. It is a wise manager who knows the limits of his company's ability, but if the foundry does not offer help in casting design, who will? Can we continue to insist that our customers' engineers learn all about our process as well as being outstanding in their own fields?

Virtually every casting starts on a designer's drawing board. In this view, Charles F. Walton, author of this article, discusses use of strain gages in casting design with a group of engineers

I doubt that there is a foundryman who has not criticized the way some pattern has been made. His criticism may or may not be justified, but he does not have the proper basis for judgment until he knows the purpose and function of the casting. Causing the foundryman unnecessary trouble by poor design is certainly uneconomical, but more important to our survival is the full and efficient use of the casting process.

We can not hope to continue in competition with other materials if we do not use our process to its best economic advantage. We may complain about the stupid way a core is printed or resist a close dimensional requirement without knowing whether the extra cost of this specification in the foundry might be saved several times over in the customer's plant.

The president of a large pattern company stated recently that the majority of its pattern work is ordered by customers without the advice of a foundryman as to the aptness of the design to the casting process or on the molding method and details for most economical production.

Most foundries have not yet found how profitable it can be to spend time and money on the education of their customers and potential customers. Too many iron foundries have not made a practice of discussing the function and purpose of a new casting so that they could offer advice on casting design or on pattern design. Nor have they provided available literature on iron castings such as a list of standard specifications. The showing of movies to kindle interest in the use of iron castings seems beyond the scope of their operation, as does product development work to increase total castings applications.

This sort of creative marketing is second nature to competition of the foundry industry. It takes progressive management with a long-range viewpoint to keep an experienced and technically capable man on the road and an efficiently run foundry to supply the necessary

financial support; but it is in these less obvious ways that we are losing out.

By contrast, nonprogressive management seems interested in bidding only for work already being produced as an iron casting. This unimaginative approach to more work, often without a true knowledge of the casting requirements, not only is short-sighted for the individual foundry, but also makes a difficult situation for the progressive foundry which is expending funds to develop new work in iron.

Ductile Iron—One of the bright spots in our industry is the continuing growth of ductile iron. This sprouting teenager is being looked on with favor by more and more foundries. Unfortunately, phenomenal as it is, ductile iron is not a panacea. A foundry that has not been quite successful with gray iron will not find ductile a solution to its problems, for this material requires close metallurgical control and better than ordinary foundry practice.

Because of its excellent properties, engineers expect it to perform as specified, and ductile is likely to be used in critical applications. Since it is a relatively new material, it requires even more development work with customers than does gray iron. It takes knowledge and perseverance to get ductile used in new applications for which it is suitable and to assure that the proper grade is used.

Since many of the uses are new, there often are no reference data available, and applications must be developed on an experimental basis. This development usually involves a considerable investment of both time and money by the foundry before a new application results in profitable business—and some of them do not.

Another strong point in the gray iron foundry industry is the common use of good cost accounting methods. With the support of GIFS, a sound cost accounting system has been developed and promulgated throughout the industry. Because of the importance of this program to the industry, it has been made available to foundries whether they supported the society or not. Unfortunately, some foundries have not utilized this information to remedy out-of-line costs. Many of these are companies which since have gone out of business. Most progressive foundries, however, participate actively in the society's cost reduction program to keep iron castings as competitive in the materials market as possible.

Thus, there is no simple answer to the future growth potential of the gray iron industry. Even with a better product at a more competitive price, we certainly can not rest on our laurels in technical progress. This progress even must be increased if we are to keep pace with the research and development of competitive materials and forming methods.

In addition, our vision must be extended beyond the confines of the foundry. More foundrymen must follow the growing minority of aggressive, profit-minded leaders in our industry. The future of iron castings depends upon a strong and concerted action by a strong majority of the entire industry.

What Is Needed—We must do these things:

1. Learn more about the designer's problems, how to design castings, and how to specify iron to meet his requirements.

2. Demonstrate the advantages of iron castings to designers and get their confidence by helping to obtain these advantages in their products.

3. Retain their confidence in iron castings by producing a consistently good product to approved (and continually improving) quality standards rather than by depending on our customers who inspect our castings and browbeat us into producing the necessary quality.

The tools for starting the job already are at hand. The Gray Iron Founders' Society has invested over $100,000 in an engineering handbook. Together with the coke suppliers, a series of educational films is being made (the first four are available now). A direct mail program on technical data and dollar-saving applications is being beamed to thousands of engineers and designers. Prospect lists and other marketing data for member foundries have been organized.

Leaders of the profit-minded minority are out proving that the program will work, but they can not do the job alone. This is a project for the entire industry. No individual foundry or small group of foundries can afford to do it alone, and the entire industry can ill afford to leave the job undone.

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Hundreds of designers have attended casting clinics sponsored by the Gray Iron Founders' Society. Below, audience at a Cleveland clinic

Zinc Castings

. . . are being adapted to new applications because continued research has improved diecasting methods, properties of zinc alloys, and finishing techniques

By DR. SCHRADE F. RADTKE
Director of Research
Expanded Research Program
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and
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● ZINC possesses outstanding characteristics for diecasting—whether we speak of it metallurgically or consider it from the manufacturer's or designer's point of view.

Metallurgically, its alloys have physical properties superior to those of other commonly diecast metals. Its excellent castability yields surfaces that require little, if any, conditioning; and for many applications it has good resistance to corrosion.

Because it can be cast in the hot chamber pressure diecasting machine at maximum rates far exceeding the output of other types of pressure casting equipment, zinc is a low-cost metal for the manufacturer. Its relatively low melting point means longer die life and provides low unit tooling costs plus minimum rejects due to incipient die failure.

In addition, less expensive alloys can be used for zinc dies. Scrap reclamation and drossing losses are minimized. Superior castability means minimum die prove-in and minimum time before acceptable castings are in production.

The designer obtains maximum flexibility from zinc with regard to complexity of shape, size of permissible castings from miniature to truly spectacular shapes, superior surface for subsequent finishing, and a wide range of permissible and economical decorative and protective finishes—plating, paints, lacquers, enamels, plastic coatings, and electrochemical finishes.

History of Zinc Diecasting Alloys[1]—The first commercial zinc diecasting alloy consisted of 6 per cent tin, 3 per cent copper, and the balance Prime Western zinc. It had relatively poor castability and low strength, but stable properties.

Improvement in castability was obtained by the addition of 0.5 per cent aluminum, but the resulting alloy suffered from intergranular corrosion and decreased service life. The base was changed from Prime Western to High Grade zinc, but this step did not improve the alloy because the detrimental effect of tin in the presence of aluminum was too great to overcome the beneficial effect from low lead and cadmium in the higher purity zinc base.

Next followed the 12 per cent aluminum, 3 per cent copper—High Grade zinc diecasting alloy, but instability of that alloy caused its early demise. The 5 per cent aluminum—3 per cent copper—balance High Grade zinc followed the 12-3 alloy. It yielded strengths equivalent to those of 12-3 alloy, but with improved stability. It enjoyed widespread commercial usage from 1922 to 1932.

Alloy development continued during this period, and the significant alloy addition introduced was magnesium. Although it made the alloys under study somewhat hot short and therefore more difficult to diecast, it tremendously reduced the growth of diecastings on aging and showed further dimensional stability with each improvement in the purity of the zinc base employed.

Of great value in developing the improved diecasting alloys was the activity of ASTM Committee B-6 and its exposure program, which provided the necessary corrosion data for guiding the development of these new alloys.

The commercial development of 99.99 per cent pure zinc (Special High Grade) by electrolysis, later followed by the distillation process, provided the basic metal for the internationally famous Zamak alloys, which were under development by New Jersey Zinc Co. during the 1920s and 1930s. Zamak, patented in 1926, was based on High Grade zinc, however, and alloys in the balance of the series—2, 3, 3N, 4, 5, and 6—were based on Special High Grade zinc.

Of these alloys, Zamak 3 (AG40A) and 5 (AC41A) have become the truly successful alloys of the original series. The properties of these two alloys are reviewed in Table I.

Chemical Composition—Of significance are the composition limits of zinc-base alloys in ingot form for diecastings (ASTM Specification B240-57T) and zinc alloy diecastings (ASTM Specification B86-57T).

Controlling the limits of lead, tin, iron, and cadmium is of tremendous importance since they, in turn, dramatically affect the service life, dimensional stability, and sensitivity to corrosion of zinc-base diecastings. Quality control of chemical composition therefore is of major sig-

nificance if the qualities of zinc diecastings are to be realized.

The American Die Casting Institute "ADCI-M11-57T Certified Zinc Alloy Plan for Die Castings"[2] has been a significant factor in insuring superior zinc diecastings for the consumer. The plan embraces periodic sampling of castings of members of the program on a regular and spotcheck basis, on penalty of suspension or revocation of the license of those who fail to meet the required standards.

The development of Special High Grade zinc has been a truly significant achievement. With the exception of lead, no other metal is available in tonnage quantities at a premium of only a few cents over conventional grades. In most metals, an increase of purity from 99.3 per cent to 99.99 per cent commands a minimum premium of approximately 100 per cent over the lower purity.

This continued offering of commercial quantities of zinc at higher and higher purity has, of course, meant a superior product for the consumer. Yet, it does demand close quality control all along the line to provide the consumer with superior performance in the castings. The physical properties of Zamak 3 and 5 are summarized in Table II.

TABLE I—Chemical Requirements, Zamak 3 and 5

	B 240 (Ingot)		B 86 (Diecastings)	
	Alloy AG40A (XXIII)	Alloy AC41A (XXV)	Alloy AG40A (XXIII)	Alloy AC41A (XXV)
Copper, %	0.10 (max)	0.75-1.25	0.25 (max)	0.75-1.25
Aluminum, %	3.9-4.3	3.9-4.3	3.5-4.3	3.5-4.3
Magnesium, %	0.03-0.06	0.03-0.06	0.03-0.08	0.03-0.08
Iron, % (max)	0.075	0.075	0.100	0.100
Lead, % (max)	0.005	0.005	0.007	0.007
Cadmium, % (max)	0.004	0.004	0.005	0.005
Tin, % (max)	0.002	0.002	0.005	0.005
Zinc	Remainder	Remainder	Remainder	Remainder

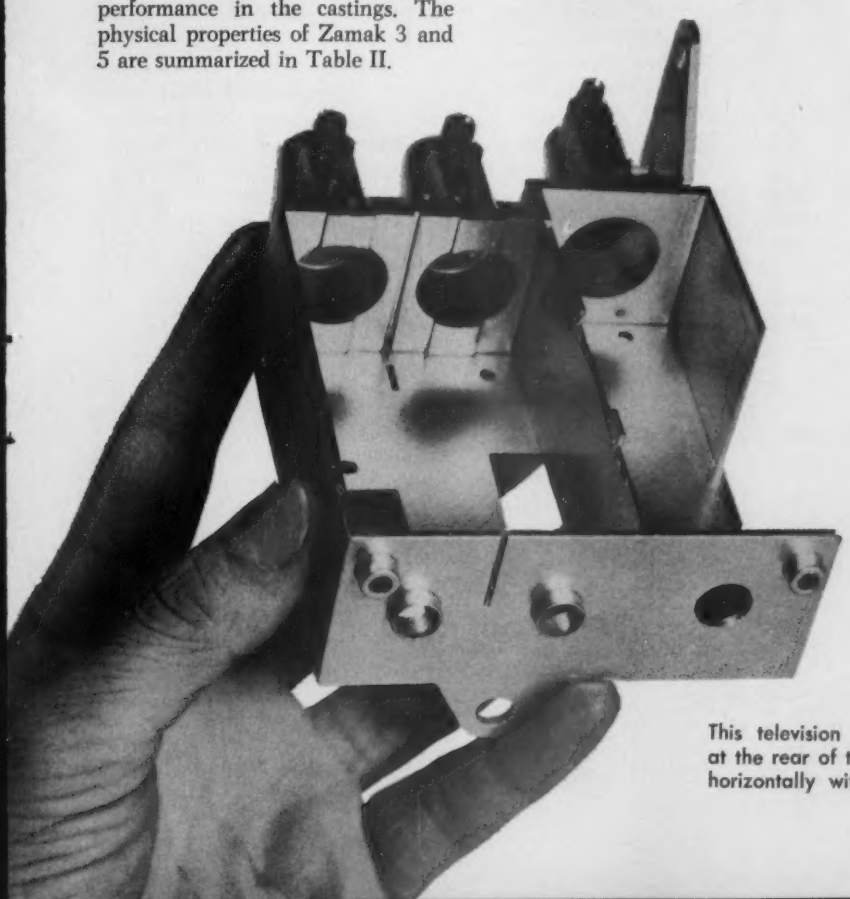
TABLE II—Physical Properties, Zamak 3 and 5

ASTM SAE	AG40A (XXIII) 903	AC41A (XXV) 925
Mechanical Properties		
Charpy impact strength, ft-lb, ¼ x ¼-in. bar, as cast	43	48
Charpy impact strength, ft-lb, ¼ x ¼-in. bar, after 10 years indoor aging	41	40
Tensile strength, psi, as cast	41,000	47,600
Tensile strength, psi, after 10 years indoor aging	35,000	39,300
Elongation, % in 2 in., as cast	10	7
Elongation, % in 2 in., after 10 years indoor aging	16	13
Expansion (growth) inch per inch after 10 years indoor aging at room temperature	0.00008	0.00007
Other Properties and Constants (As Cast)		
Brinell hardness	82	91
Compression strength, psi	60,000	87,000
Electrical conductivity, Mhos/cm at 20° C	157,000	153,000
Modulus of rupture, psi	95,000	105,000
Shearing strength, psi	31,000	38,000
Melting point, ° C	380.6	380.4
Melting point, ° F	717.1	716.7
Solidification point, ° C	380.6	380.4
Solidification point, ° F	717.1	716.7
Specific gravity	6.6	6.7
Specific heat, cal/g/° C	0.10	0.10
Thermal conductivity, cal/sec/aqcm/cm/° C at 18° C	0.27	0.26
Thermal expansion per ° C	0.0000274	0.0000274
Thermal expansion per ° F	0.0000152	0.0000152
Transverse deflection, in.	0.27	0.16
Weight, lb/cu in.	0.24	0.24

Zinc diecastings provide the product designer maximum flexibility combined with minimum limitations. The important design criteria for zinc castings have been presented in many publications of the producers[3] of Special High Grade Zinc and in the ASM *Metals Handbook*. An important source of data for the designer is the set of "Product Standards for Die Casting" available from the American Die Casting Institute.

Latest Zinc Alloy—These contributions from all segments of the associated industries have made zinc diecasting alloys outstanding. But development has not stopped at this point, and continuing progress is being made in all phases. Recently, New Jersey Zinc Co. announced a new alloy, Zamak 7. This alloy, basically a modification of Zamak 3, provides improved castability as compared with Zamak 3 and 5.

Although magnesium contributes to improved subsurface corrosion resistance and dimensional stability, it definitely lowers castability of the zinc alloys. Since castability is principally a function of the magnesium content, best castability would be achieved with no magnesium present.



This television tuner housing requires three cores at the rear of the casting. They must be withdrawn horizontally within the area of two vertical cores

For example, some castings capable of being made with magnesium near the minimum limit of 0.03 per cent cannot be cast when the magnesium content is near the maximum limit of 0.06 per cent for ASTM AG40A (XXIII). On the other hand, elimination of magnesium cannot be tolerated because magnesium must be present as a safety factor against minor contamination in slab, alloy, or remelt stock.

The present Zamak alloys were developed with a minimum magnesium limit of 0.03 per cent to compensate for possible lead and tin contamination in diecastings from the zinc, the alloying constituents, or the remelt scrap in the diecasting plant. Today, producers of Special High Grade Zinc Slab are capable of supplying commercially high purity zinc, and diecasters, aware of the dangers of contamination, carefully control the chemistry of their melts and castings. Because of these two factors, it was believed practical to lower impurity limits in diecastings, permitting a reduction in magnesium content and thereby achieving improved castability.

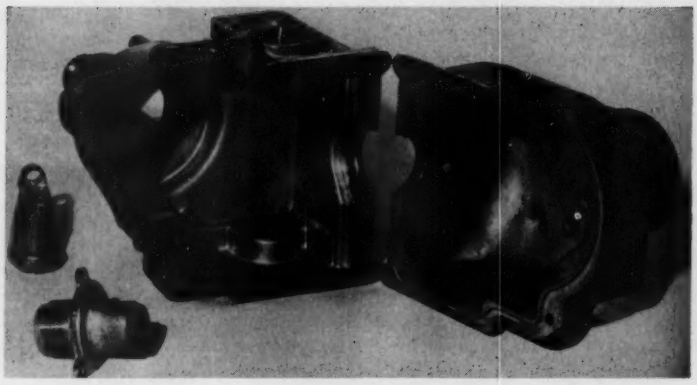
The practical minimum level of magnesium content has been reached in Zamak 7. It uses high-purity base stock with a small nickel addition, and appropriate service life of the resulting casting is maintained together with improved casting characteristics. The latter result in increased production rates; fewer rejects; larger and more complex castings; improved surface finish which minimizes preplating conditioning; lower casting temperatures, and achievement of thinner sections and less critical die design.

The tentative chemical operating limits of Zamak 7 ingot and castings are shown in Table III.

On the basis of typical properties of test specimens, mechanical properties for Zamak 7 compare to those of Zamak 3 as shown in Table IV.

Ten-year indoor aging tests on Zamak 7 show that it has the same degree of permanence of properties and dimensional stability as Zamak 3.

Because of the close chemical operating limits, care must be exercised in alloy preparation and scrap remelt to insure that the necessary purity limits are maintained. Reworked metal which does not meet Zamak 7 specifications may be used for Zamak 3 heats provided that the magnesium content is readjusted to Zamak 3 operating limits.



Diecast zinc components are used in an automotive speed control device. Wall thicknesses vary widely in these diecastings

Expanded Research Program—In its desire to improve present zinc products and expand their total usage, the zinc industry here and abroad established the Expanded Research Program through the American Zinc Institute. Because of the great importance of diecasters and consumers of zinc diecastings to the zinc industry, it was obvious that one of the first considerations would be to review the performance of existing zinc diecasting alloys. For all metals, engineering requirements over the years have demanded improved performance in virtually all properties; and zinc was no exception.

Despite the excellent performance of zinc alloys in the past, the industry felt that improvements in physical properties, castability, creep strength over a wider range of operating temperatures, and improved finishing characteristics would contribute materially to extending their range of performance and widening their field of application.

These requirements were made the goal of an alloy development program the zinc industry placed with the laboratories of New Jersey Zinc Co. The first phase of the industry program, however, limited the scope to alloys which could be cast in the hot chamber diecasting machine to achieve all of the benefits of this process discussed in earlier paragraphs. It was believed that the zinc-aluminum binary system with minor alloying additions held the greatest promise of achieving success for our goals. The hot chamber process set another parameter by limiting the composition to 5 to 18 per cent aluminum additions.

To date in this research, two basic compositions—8 per cent aluminum-zinc and 14 per cent aluminum-zinc—have been most successful. Most noteworthy has been the 8 per cent aluminum, 0.5 per cent copper zinc alloy with minor additions of elements from the iron group of the periodic table.

Bearing in mind that these are experimental alloys only, produced in the laboratory with no production data to report, a number of improvements have been observed. As-cast tensile properties from 41,000 to 49,000 psi, impact strengths from 28 to 33 ft-lb, hardness from 80 to 96 Bhn, and elongations from 9 to 21 per cent have been obtained. There are indications that high fluidity and excellent castability are characteristics of these alloys.

It is planned to conduct pilot production runs, at the earliest possi-

TABLE III—Chemical Requirements, Zamak 7

	Ingot	Castings
Aluminum, %	3.9-4.3	3.5-4.3
Copper, %	0.10 (max)	0.25 (max)
Magnesium, %	0.005-0.020	0.005-0.020
Nickel, %	0.005-0.020	0.005-0.020
Lead, %	0.0020 (max)	0.0030 (max)
Cadmium, %	0.0020 (max)	0.0020 (max)
Tin, %	0.0010 (max)	0.0010 (max)
Iron, %	0.050 (max)	0.075 (max)
Zinc, %	Balance	Balance

TABLE IV—Mechanical Properties, Zamak 7 and 3

Mechanical Properties (Room Temperature, as cast)	Zamak 7	Zamak 3
Tensile strength, psi (¼ in. min)	41,000	41,000
Impact strength, ft-lb (¼ x ¼-in. Charpy)	40	43
Brinell hardness (500-kg load, 10-mm ball, 30 sec)	76	82
Elongation, % in 2 in.	14	10

ble date, of the final composition selected to establish production operating limits of compositions and confirm the properties obtained in laboratory tests.

Although the above results appear promising, work is continuing unabated to improve these alloys further, particularly with respect to creep and elevated temperature properties. In the present program, other compositions will be explored with emphasis on the hot chamber machine. Subsequent programs will consider alloys for the cold chamber process.

Because of the great importance of diecasting to the zinc industry, all phases of diecastings are or soon will be under investigation. A study of flow in diecasting dies now is under way as a joint venture of the Expanded Research Program of the American Zinc Institute, the Die Casting Research Foundation of the American Die Casting Institute, and the American Foundrymen's Society.

Plating Advances—For the last five years, a program for improving plated finishes for zinc diecastings has been under way at Battelle Memorial Institute under the sponsorship of the Expanded Research Program of the American Zinc Institute. This program has had major support from the producers of plating chemicals, the platers, and the automotive industry.

From this co-operative effort, significant improvement in corrosion resistance of plated finishes has been obtained. In addition to achieving superior resistance to the increasingly severe exposure conditions encountered by exterior plated castings, it has been shown that certain of the plating systems (duplex nickel-type coatings) also provide improved impact strength as compared to the conventional bright nickel castings.

The superior plating systems are as follow: 1. Conventional copper followed by duplex nickel and conventional chromium. 2. Conventional copper followed by bright nickel and crack-free chromium. 3. Conventional copper followed by duplex nickel and crack-free chromium. 4. Conventional copper followed by duplex nickel (or bright nickel) and duplex chromium.

Adoption of these systems by the automotive industry is resulting in superior performance of plated die castings. The increasingly severe exposure conditions traceable to rapidly growing air pollution and the use of salt (sodium as well as calcium chloride) on the nation's highways create, however, a constant race to provide adequate life in the face of increasingly severe environments.

Research in improving plating systems is continuing unabated in the United States and abroad. The programs are co-ordinated through a continuing exchange of technical data and plated samples. The efforts of plating suppliers, platers, and the automotive industry, together with the zinc industry program at Battelle, are contributing significantly to the improvement of the position of zinc in the diecasting industry.

Electrochemical Finish — Several years ago, Consolidated Mining & Smelting Co. of Canada Ltd. developed an electrochemical finish for zinc which appears to have merit for decorative as well as protective applications.

The finish is a fritted-type coating analogous to a porcelain enamel finish. It is applied to cleaned castings exposed to an ac or dc potential varying from 0 to 250 v in an aqueous solution of ammonium chromate, ammonium phosphate, and ammonium fluoride at 75 to 95° C, at a current density of 50 amps/ft² for a period of six to nine minutes.

It yields a coating thickness of approximately 50 microns, olive drab in color, with good abrasion resistance and capable of withstanding 1000 hours of exposure in an ASTM salt spray chamber without exhibiting evidence of substrate corrosion. It provides an excellent paint base.

Ductility of the coating is limited; but, nevertheless, the coating has characteristics deserving of commercial exploitation. It is planned to license the process through the Expanded Research Program.

Fundamental Research — Beyond the applied research described here, the zinc industry, through its Expanded Research Program and in the laboratories of the producing companies, is conducting fundamental research which may one day contribute significantly to the improvement of zinc diecastings. Studies of the zinc-aluminum binary system, the surface characteristics of zinc, new alloy systems via particulate metallurgy, and surface tension and viscosity of zinc and its alloys are under investigation.

This balanced program of applied and fundamental research means continued progress for producers as well as users of zinc diecastings.

The continuing research of the zinc industry and the industries associated with it should be evident from this review. The objectives are to provide superior products to meet the increasingly stringent demands of the ultimate consumer.

Dash console is a one-piece zinc diecasting weighing only 13 lb. Casting is 34¾ in. long, 15 in. wide, and 4 in. deep

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Meeting Competition Through Improved
FOUNDRY TECHNOLOGY

Magnesium Castings

. . . quality levels have been raised by missile requirements. Development of new alloys, fluxes, processes, and inspection methods has helped castings keep pace

By ROBERT C. BOEHM*
Quality Control Manager and Chief Metallurgist
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● THE ERA of jet engines and missiles has necessitated the establishment of exceptionally high standards of quality and reliability. The fact that magnesium foundry development has kept pace with the aircraft and missile industries is a significant accomplishment. Many cast magnesium parts employed in military aircraft and missiles are of great complexity and must meet exceedingly high quality standards.

Alloy Development — A major problem in aircraft and missile manufacturing is the need for materials capable of withstanding the tremendous forces and temperatures of supersonic flight. Development of new magnesium alloys has followed this changing requirement.

Magnesium has been used successfully in many structural applications. However, the standard alloys of the magnesium-aluminum-zinc system are not recommended for stressed applications at temperatures above 300° F. Through introduction of the magnesium—rare earth—zirconium alloys, such as EZ33A, castings can be produced with outstanding tensile and creep properties in the neighborhood of 400° F.

EZ33A also is an excellent feeding alloy and should be recommended in any application where pressure tightness is the major service requirement. Today, the magnesium—rare earth—zirconium alloys are accepted as standard material for aircraft castings.

Didymium, a rare-earth metal consisting of approximately 85 per cent neodymium and 15 per cent praseodymium, is used to replace mischmetal in alloy EK31A. This alloy has higher strength at elevated temperatures and better room temperature properties than the established EZ33A alloy. Didymium costs substantially more than mischmetal, and the casting characteristics of EZ33A are much better than EK31A. Because of these factors, alloy EK31A has not been used extensively.

Requirements Go Up—As aircraft and missile operating speeds and temperatures increased, the search for new alloys to meet the requirements imposed resulted in development of the magnesium-thorium-zirconium alloys. These alloys, such as HK31A, are not used as extensively as the magnesium—rare earth—zirconium alloys, but they have reached volume production and are giving outstanding performance in service.

The magnesium—thorium—zirconium alloys are being employed to produce parts with good properties at operating temperatures of 400 to 700° F. They are particularly good for short time elevated temperature applications at high stresses and their increasing use in missiles and aircraft is almost certain. The magnesium—thorium—zirconium alloys require close control in the foundry. However, as experience has been gained in working with the alloys, production problems have been reduced.

The magnesium—zinc—zirconium alloys ZK51A and ZK61A have high room temperature properties but poor casting characteristics. Furthermore, they are difficult to weld repair. It has been determined that the welding and casting characteristics of these alloys are improved materially by additions of rare earths or thorium.

New alloys based on the magnesium — silver — didymium—zirconium system currently are being

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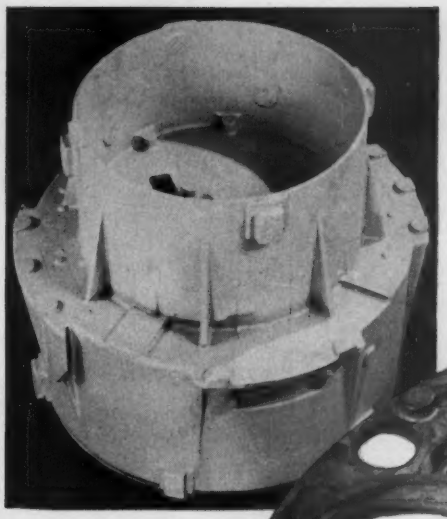


Fig. 1—New, high-damping capacity magnesium-zirconium alloy K1A[2] is being used in electronic control mechanisms of missile guidance systems. This view is of a sand-cast electronic control housing

Fig. 2—Alloy K1A also is used in this diecast instrument mounting plate used inside the sand-cast housing shown in Fig. 1 and 3

Fig. 3—This view of the housing interior shows bosses for the mounting plate which holds electronic control instruments

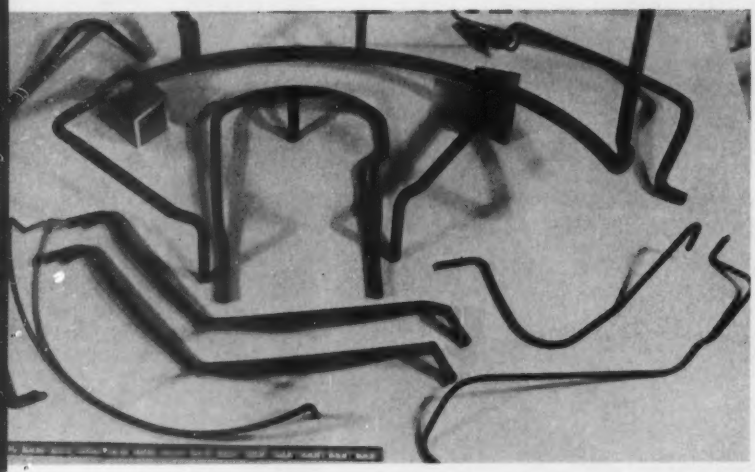
tested. Alloy QE22 or the British designation MSR has the best yield strength of the current magnesium-base sand casting alloys in the temperature range of 0 to 500° F.[1] It has good room temperature properties and retains its good strength to fairly high temperatures. The alloy shows good retention of Young's Modulus with temperature and can be employed for short-term, high-temperature applications in the field of missiles.

As with most magnesium alloys containing zirconium, the tensile properties of specimens cut from a casting are of the same magnitude as those obtained from separately cast test bars. Furthermore, alloy QE22 provides exceptionally uniform properties in different parts of a casting regardless of the section size. Although the alloy has numerous desirable features, its use in high-production applications may be restricted by the high cost of the alloying elements.

A recently developed magnesium—zirconium alloy has a high damping capacity that can be expected to absorb vibrations and thus reduce concomitant induced stresses. Alloy K1A[2] is being used successfully in electronic control mechanisms of missile guidance systems, as is shown in Fig. 1, 2, and 3.

This alloy exhibits a good combination of damping capacity, corrosion resistance, castability, and mechanical properties. It has several times the specific damping capacity of cast iron with one-fourth the weight.

Flux Development—Flux and oxide inclusions have been major problems in the casting of magnesium alloys containing zirconium. Although the early development of No. 311 flux provided a means of



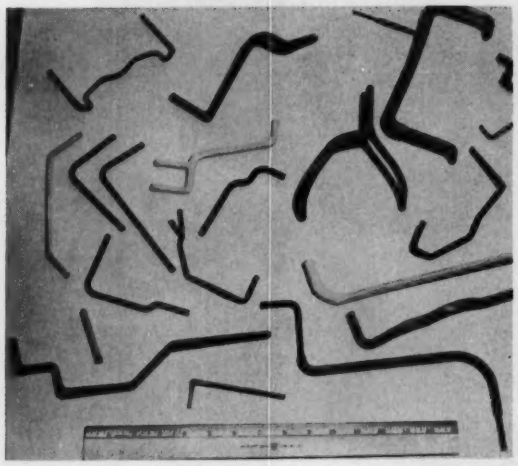


Fig. 4 and 5—Typical cores for forming unlined passages in light metal castings are shown in these two views. Cores are of refractory or metallic materials[4]

producing usable castings, the inclusion problem was decreased materially by the introduction of the HE and NZ fluxes. Recently, the two were combined and designated as HZ flux.

Flux development has reduced materially the problem of flux and oxide inclusions in castings of the exotic alloys and has decreased the metal loss attributable to excessive oxidation during melting.

Special Processes—A number of molding processes other than green sand and several coremaking processes are used where applicable in the production of magnesium castings.

Diecasting is one of the faster growing mediums for magnesium castings production. In per cent of total magnesium castings shipped, it jumped from 21 in 1955 to 32 per cent in 1960. Automotive castings account for a good part of this increase. A continuing increase in magnesium diecastings production is likely because of the favorable interrelationship of price per pound, relative weight, die mold life, and heat transfer properties of magnesium.

The Antioch process of plaster molding and the Osbrink process of sand molding are used for producing rather complex castings with very thin wall sections, high dimensional accuracy and good surface finish.

The CO_2 process of making both molds and cores has been accepted in magnesium foundries as a production technique, and current interest is focused on extending its sphere of application. Newer binders and gassing techniques are expected to accelerate use of the process in magnesium foundries.

Advantages of the CO_2 process have been enumerated often in the technical literature, and they pertain to the production of magnesium castings. However, the danger of blows from CO_2 cores, especially in internal pockets of magnesium castings, still exists. The condition can be minimized by the use of a relatively high permeability sand mix and by extensive venting.

Considerable interest is being evidenced in the newer low-gassing resin—water core and mold binders. They are said to produce dimensionally-accurate cores which give off very little gas and have good collapsibility. Performance of the furfuryl alcohol — urea resin binders also is being watched. These binders generally are cheaper than the phenolic resins used in shell cores, have quick cure times, and produce dimensionally accurate cores.

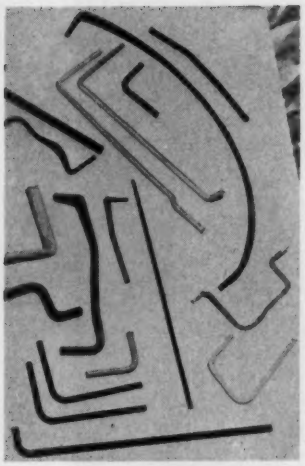
Corrosion Protection—Corrosion protection is not necessary with magnesium in applications subject to normal weathering or short-time, intermittent wetting. Protective finishes are needed, however, on castings designed for exposure to severe conditions where unprotected magnesium surfaces are susceptible to corrosion, especially salt spray corrosion. Customers in increasing numbers are specifying corrosion coating or other additional processing for their castings.

Development of the HAE coating was a major advance in corosion protection for magnesium. It is an electrolytically-applied coating 0.001 to 0.0015 in. thick. In addition to good corrosion resistance, it has a high melting point, good dielectric strength, high hardness, and is a good base for paints.

A process known as Dow No. 17 produces a refractory ceramic type of abrasion-resistant coating. It is applied by the use of an aqueous acidic electrolyte containing phosphate, fluoride, and chromate ions. The treatment does not require an initial pickle to remove surface contamination nor pre- or post-treatment to obtain uniform coatings or to improve paint adhesion.

A fluoride anodizing process recently developed and licensed by Magnesium Elektron Inc. is designed to etch out oxide skins, dross, and any flux that might be at the surface of a casting. It also is said to remove bits of wire brushes, steel wool, shot, and abrasives left from blasting or coated abrasive cleaning.

Chemical milling is another process being specified by casting buyers. It involves removing metal by chemical etching and may be used to lighten a casting or to produce a more complicated part by selective etching. That is done by masking the areas of a casting that are to remain unetched. It is reported that tolerances of ± 0.002 in. and



surface finishes of 100 to 200 microinches rms can be procured.

Lined and Unlined Passages—Developments in recent years permit the casting in light metal parts of complex passages which can not be formed by the use of conventional sand cores either because the cross-sectional area of the casting is too small or the unsupported span of the core is too long. The passages are termed lined, unlined, tubeless, and cored. The latter three terms are used interchangeably.

The casting of stainless steel tubes into a part was a major advance in the creation of passages for the transfer of fluids in that part. Further advances in foundry techniques have made possible production of tubeless passages of the same configuration as the cast-in tubing.[3,4] Fig. 4 and 5 show cores used to make typical unlined passages.

The incorporation of passages in castings provides a degree of design freedom. Design engineers need not be restricted to straight line configurations, nor need they be concerned about the proper intersection of drilled passages. Cast-in passages can be streamlined for reduced pressure drop and turbulence of the fluid flowing through the passages.

In many instances, particularly for complex castings, cast-in passages can result in cost savings in the machined assembly. These passages also reduce or eliminate outside "plumbing," resulting in a better looking final assembly and in one requiring less maintenance.

All of these things are plus values for the customer and should result in expanded production of this type of casting in the future.

Inspection Techniques—New inspection procedures receive rapid recognition and application in magnesium foundries probably because a large percentage of magnesium castings is sold to aircraft and missile manufacturers who have high inspection standards.

One of the newer inspection methods is the Etch Precipitation Inspection Test known widely as the Sikorsky Acid Etch Test. It involves a chemical procedure for detecting flaws in rough magnesium alloy castings. Fundamentally the procedure employs chromic acid to penetrate and enlarge the defect, then exaggerates the chromic acid bleed-out from the defect with a bright-colored dye. The dye also forms a tenacious precipitate when it reacts with the chromic acid. Details of the procedures are shown in Fig. 6.

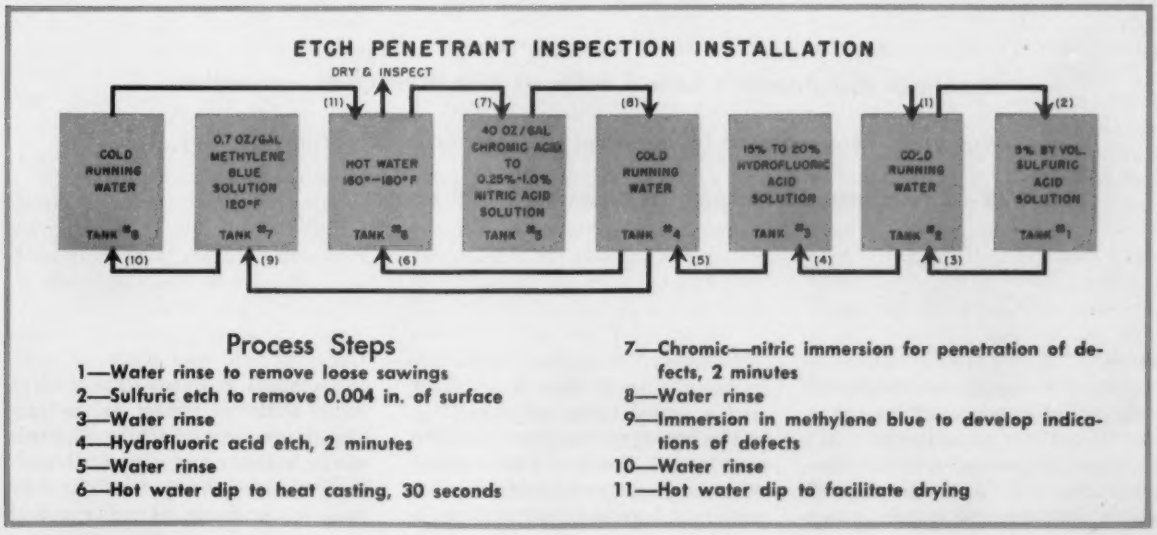
In the field of fluorescent penetrant testing, new penetrants and developers are said to provide greater sensitivity with more brilliant fluorescence, making detection of discrepancies easier. Development of a separate emulsifier for use in the Zyglo test is claimed to increase the penetrating power of the penetrant and to permit the use of larger quantities of fluorescent material. The result is that casting flaws can be detected more readily and with greater accuracy.

References

1. "MSR a New High Strength Magnesium Casting Alloy," bulletin of Magnesium Elektron Inc., New York.
2. "High Damping Characteristics of Magnesium," Bulletin 141-194, Dow Chemical Co., Magnesium Department, Midland, Mich.
3. G. Sandenburgh, "Cast-in Inserts and Tubeless Passages in Magnesium Castings," a paper presented to the Society of Aircraft Materials and Process Engineers and the Magnesium Association, June 4, 1958, Los Angeles.
4. H. E. Elliott and J. G. House, "Forming Unlined Passages in Light-Metal Castings," FOUNDRY, September, 1960, p. 98.

Fig. 6—Processing steps for one of the newer casting inspection methods are given. A defect is enlarged and colored brightly for easy detection

● For an extra copy of this article, until supply is exhausted, use card on Page 39



Process Steps

1—Water rinse to remove loose sawings
2—Sulfuric etch to remove 0.004 in. of surface
3—Water rinse
4—Hydrofluoric acid etch, 2 minutes
5—Water rinse
6—Hot water dip to heat casting, 30 seconds
7—Chromic—nitric immersion for penetration of defects, 2 minutes
8—Water rinse
9—Immersion in methylene blue to develop indications of defects
10—Water rinse
11—Hot water dip to facilitate drying

AFS CASTINGS CONGRESS

American Foundrymen's Society holds its first West Coast convention this year. Thousands of foundrymen will gather in San Francisco May 8-12 to attend 50 technical sessions with 100 papers

● FOR THE FIRST time, the American Foundrymen's Society this year will hold its annual meeting on the West Coast when the 65th AFS Castings Congress meets in San Francisco May 8-12. Attractions include about 100 technical papers at approximately 50 sessions, visitations to more than 20 Bay Area plants, and a varied ladies program.

Headquarters for the Congress will be the Sheraton Palace Hotel, where registration, technical sessions, and most special events during the Congress will take place.

Technical Program—The 100 or more technical papers to be presented represent virtually all fields of the industry and cover such general areas as basic research, new looks at fundamental subjects, and

Official U. S. Navy Photo

Left, Telegraph Hill looks over Alcatraz to the Marin County shore. Above, partial view of Mare Island Shipyard. Foundry (lower right) will be open for visitations

developments in current techniques.

Papers will be sponsored by these divisions: Light Metals, Brass and Bronze, Gray Iron, Malleable Iron, Pattern, Sand, Steel, Die Casting and Permanent Mold, and Ductile Iron. Other sessions will be sponsored by general interest committees including Fundamental Papers, Heat Transfer, Industrial Engineering and Cost, Plant and Plant Equipment, and Safety, Hygiene, and Air Pollution. A symposium on vacuum melting and casting will be co-sponsored by the Steel Division and the Fundamental Papers Committee.

Roundtable luncheons include the following: Brass and Bronze, Tuesday; Pattern, Tuesday; joint Ductile Iron, Gray Iron, and Malleable Iron, Wednesday; Light Metals, Wednesday; Die Casting and Permanent Mold, Thursday; and Steel, Thursday.

Shop Courses—A total of six shop courses will be offered, all at 8 p.m. on various nights. They include Sand and Pattern courses on Monday night, Gray Iron and Sand on Tuesday, and Ductile Iron and Gray Iron on Thursday evenings.

The Pattern course will cover hard and soft plasters; the Gray Iron courses will deal with cupola operation and production of different irons from the same heat; the Ductile Iron course will discuss production of ductile iron; and the Sand courses will concern green sand properties and use of furfural binders.

Business Meeting—There will be no technical sessions Wednesday morning while the annual business meeting is held. The program at this meeting includes an address by President Norman J. Dunbeck, the election of officers and directors, apprentice contest awards, and presentation of AFS awards of scientific merit and service citations (see Page 162). The Charles Edgar Hoyt Memorial Lecture will be presented by J. B. Caine, consultant, Cincinnati. Mr. Caine's subject is "Cast Metals and Cast Shapes."

Nominees selected for election at the annual business meeting are Albert L. Hunt, executive vice president, Superior Foundry Inc., Cleveland, president, and John A. Wagner, president, Wagner Castings Co., Decatur, Ill., vice president.

Director nominees are Daniel B. Best, superintendent, Brass & Iron Foundries, Bethlehem Steel Co., Bethlehem, Pa.; Roger J. Hageboeck, vice president, Frank Foundries Corp., Moline, Ill.; Dale Hall, works manager, Oklahoma Steel Castings Co., Tulsa, Okla.; C. J. Lonnee, president, Alloyed Grairon Casting Corp., Ravenna, Mich.; Charles Ossenfort, foundry superintendent, Fairbanks, Morse & Co., Kansas City, Kans.; and Carl O. Schopp, assistant general superintendent, Link-Belt Co., Indianapolis.

M. E. Nevins, president, Wisconsin Centrifugal Foundry Inc., Waukesha, Wis., and vice president, Waukesha Smelting Co., has been named an AFS director for three years, 1961-64, by the society's board of directors.

Annual Banquet—AFS Gold Medal Awards will be presented Wednesday night at the society's annual banquet, which will be held in the Garden Court of the Sheraton Pal-

ace Hotel. The banquet program this year will feature entertainment, with the emphasis on barbershop singing. A 60-man chorus and a number of championship quartets will perform.

Ladies Activities—The ladies program committee, with Mrs. S. D. Russell and Mrs. John R. Russo as co-chairmen, has arranged an active, interesting four-day schedule to entertain the ladies.

It opens with a tea on Monday at which everyone will have an opportunity to get acquainted. Other events include a fashion show with an Oriental motif at the Mark Hopkins Hotel on Tuesday, a continental breakfast at the St. Francis Hotel and a backstage tour of smart shops on Wednesday, and a conducted tour of the city on Thursday.

Plant Visitations—An outstanding plant visitation program will open more than 20 Bay Area foundries to Castings Congress visitors. A list of these plants is on p. 155 and includes information concerning the types of castings produced by each shop.

Committees—Northern California Chapter will be host chapter for the Castings Congress, and S. D. Russell, Phoenix Iron Works, is chairman of the host chapter committee. John R. Russo, Russo Foundry Equipment Co., is vice chairman, and Davis Taylor, Wheelabrator Corp., is secretary-treasurer.

COMMITTEE CHAIRMEN

S. D. RUSSELL

NORTHERN CALIFORNIA Chapter of AFS is host chapter for the Congress. Chairman of the host chapter committee is S. D. Russell, Phoenix Iron Works. John R. Russo, Russo Foundry Equipment Co., is vice chairman, and Davis Taylor, Wheelabrator Corp., is secretary-treasurer. Hugh F. Prior, Superior Electrocast Foundry Co., is president of Northern California Chapter, and Michael E. Ginty, Vulcan Foundry Co., is vice president.

Other committee chairmen include: Robert A. Johnston, Amador Minerals Co., shop course committee; J. M. Snyder, National Abrasives, publicity chairman; Clayton D. Russell, Phoenix Iron Works, ladies activities committee; Lane M. Currie, H. C. Macaulay Foundry Co., banquet committee; Donald C. Caudron, Pacific Brass Foundry of San Francisco, reception committee; and Charles R. Marshall, Industrial & Foundry Supply Co., plant visitation committee.

JOHN R. RUSSO

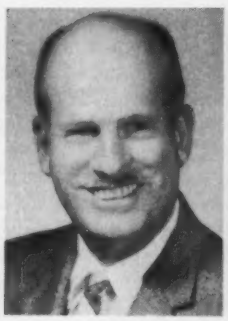
DAVIS TAYLOR

ROBERT A. JOHNSTON

MICHAEL E. GINTY

HUGH F. PRIOR

CLAYTON D. RUSSELL



CHARLES R. MARSHALL

DONALD C. CAUDRON

LANE M. CURRIE

J. M. SNYDER

PLANT VISITATIONS

. . . Wide Choice Available at San Francisco

● FOUNDRYMEN attending the AFS Congress in San Francisco can make a choice from about 20 Bay Area foundries for plant visits.

Arrangements for inspection of a wide variety of castings operations have been made by a Northern California Chapter committee headed by Charles R. Marshall, Industrial & Foundry Supply Co. Foundries open to visitors consist of both ferrous and nonferrous shops producing small, medium-sized, and large work, and including such specialties as pressure pipe, soil pipe, and fittings.

The plant visitation list includes leading ones of the area's approximately 75 foundries. They are situated in Berkeley, Oakland, Richmond, San Francisco, South San Francisco, and Vallejo.

Smaller shops are expected to be open daily for visits, the larger plants on one or more scheduled days. Information on hours and transportation will be available from the Plant Visitation Committee, which will maintain a headquarters desk in the Sheraton-Palace lobby.

The Naval Shipyard—A visit to the foundry of the Mare Island Naval Shipyard at Vallejo is planned for Thursday, May 11. This huge operation, established in 1854, now is one of the key bases for the Pacific nuclear-powered submarines. It has built about 500 vessels ranging from landing craft to battleships and including submarines, in addition to performing considerable overhaul, conversion, and repair work.

The Mare Island foundry casts gray iron, steel, brass and bronze, aluminum, and zinc, with individual castings varying in weight from a few ounces to 65,000 lb. Melting capacity is provided for 40,000 lb of electric steel of various alloys, 70,000 lb of copper-base alloys, 2000 lb of aluminum-base alloys, and 6000 lb of nickel-base alloys. The Shipyard also has a modern and well equipped pattern shop.

Bay Area Foundries Open for Visits

American Brass & Iron Foundry, 7825 San Leandro St., Oakland
Soil pipe and fittings

American Brake Shoe Co., Amsco Div., 850 Ferry St., Oakland
Manganese steel castings

American Radiator & Standard Sanitary Corp., 1089 Essex St., Richmond
Gray iron sanitary ware castings

Atlas Foundry & Mfg. Co., 3701 Collins Ave., Richmond
Gray iron production castings

DeSanno Foundry & Machine Co., 1919 Peralta St., Oakland
Small brass and aluminum castings

East Bay Brass Foundry, 1200 Chesley Ave., Richmond
Green sand, shell and permanent mold brass and aluminum castings

Empire Foundry Co. Inc., 950 19th Ave., Oakland
Iron and steel jobbing castings

General Metals Corp., 550 85th Ave., Oakland
High-production iron and steel castings

M. Greenberg's Sons Inc., 765 Folsom St., San Francisco
Nonferrous valves and fittings, ornamental bronze

H. C. Macaulay Foundry Co., 811 Carlton St., West Berkeley
Gray iron jobbing castings, including Offenhauser engine blocks

Mare Island Naval Shipyard, Vallejo
Iron, steel, and nonferrous castings for Navy vessels

Pacific Brass Foundry of San Francisco Inc., 251 Second St., San Francisco
Brass and aluminum jobbing castings

Pacific Pressure Cast Products, 1210 Fourth St., Berkeley
Aluminum matchplates, ceramic mold castings

Pacific Steel Casting Co., 1333 Second St., Berkeley
Small and medium-sized steel castings

Knute Palmquist Foundry Inc., 4933 San Leandro St., Oakland
Brass and aluminum jobbing castings

Phoenix Iron Works Co., Second & Castro Sts., Oakland
Gray iron jobbing castings

San Francisco Iron Foundry, 260 Townsend St., San Francisco
Small gray iron jobbing castings

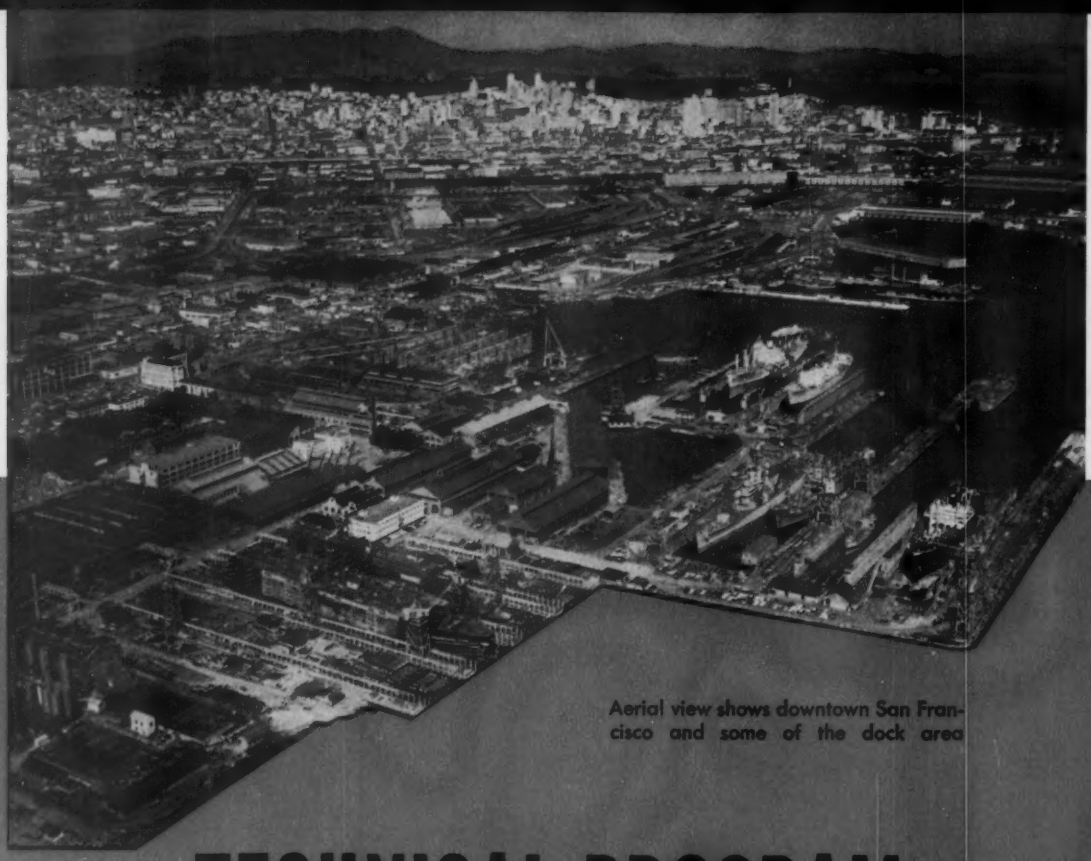
Service Pattern & Foundry Co., 2870 Chapman St., Oakland
Brass and aluminum jobbing castings

Superior Electrocast Foundry Co., 150 Harbor Way, South San Francisco
Small and medium-sized steel castings

United States Pipe & Foundry Co., Union City, Calif.
Cast iron pressure pipe (DeLavaud process)

University of California, Engineering Dept., Berkeley
Student foundry laboratory

Vulcan Steel Foundry Co., 2934 Ford St., Oakland
Small and medium-sized steel castings



Aerial view shows downtown San Francisco and some of the dock area

TECHNICAL PROGRAM

··· AFS Castings Congress

MONDAY, MAY 8

8:30 a.m.—Registration opens (to 5:30 p.m.)
9 a.m.—Ladies registration opens (to 3 p.m.)
9:30 a.m.—Brass and Bronze Session.

Weld Repair of High Strength Yellow Brass Castings—D. K. Fox, Westinghouse Electric Corp., East Pittsburgh, Pa.

Compositions and Microstructures of Consistently Weldable As-Cast Nickel-Aluminum Bronze—S. Goldspiel, M. L. Foster, New York Naval Shipyard, Brooklyn, N. Y.

9:30 a.m.—Light Metals Session

Meeting the Challenge of High Reliability Castings—W. Babington, Bell Telephone Laboratories, Murray Hill, N. J., E. E. Miller, Western Electric Co., Greensboro, N. C., W. R. Clitherow, Western Electric Co., Winston-Salem, N. C.

A Preliminary Evaluation of M517-T61 as a High-Strength Aluminum Alloy Casting Material—W. A. Bailey, E. N. Bossing, F. H. Roebuck, Douglas Aircraft Co., Santa Monica, Calif.

9:30 a.m.—Pattern Session

Machined Patterns Can Be Competitive—R. Olson, Southern Precision Pattern Works Inc., Birmingham.

Low-Melting Alloys for Pattern Fabrication and Other Uses in Pattern Shops—O. J. Seeds, Cerro Sales Corp., New York

2 p.m.—Brass and Bronze Session

Hard Spots in Aluminum Bronzes—N. A. Birch, Albion Malleable Iron Co., Albion, Mich.

Electric Melting and Quality Control of Bronze Alloys—R. V. Barone, T. F. Godfrey, R. A. Rosenberg, Walworth Co., South Braintree, Mass.

2 p.m.—Heat Transfer Session

Factors Affecting Casting Soundness in Certain Alloys with Long and Short Freezing Ranges—J. T. Berry, T. Watmough, Armour Research Foundation, Chicago

Thermal Properties of Mold Materials—M. R. Seshadri, A. Ramachandran, Indian Institute of Science, Bangalore, India.

How Much of Your Superheat is Being Lost in the Runner?—J. W. Hlinka, V. Paschkis, F. S. Puhr, Columbia University, New York

Heat Transfer Committee Report—W. K. Bock, National Malleable & Steel Castings Co., Cleveland

2 p.m.—Pattern Session

New Concept in Plastic Patternmaking (Polyurethanes)—H. Burton, Canadian Steel Foundries, Montreal, Canada. Presented by R. L. Olson, Dike-O-Seal Inc., Chicago

Motion Picture—"Application of Polyurethanes for Patternmaking"

2 p.m.—Sand Session

Preliminary Evaluation of Calcined Fluid Coke—E. G. Gentry, C. L. Leak, Humble Oil & Refining Co., Detroit

Improvements in the CO_2 Process—D. A. Taylor, British Cast Iron Research Association, Alvechurch, England.

A New Approach to Testing the High Temperature Strength of Molding and Core Sands—R. W. Heine, University of Wisconsin, Madison, Wis., J. S. Schumacher, E. H. King, the Hill & Griffith Co., Cincinnati

4 p.m.—Brass and Bronze Session

Properties and Microstructure of Cast Nickel-Containing Aluminum Bronze Alloys—E. Belkin, Westinghouse Electric Corp., East Pittsburgh, Pa.

Effect of Chemical Composition on the Structure and Properties of Aluminum Bronzes Containing Manganese, Nickel and Iron—J. O. Edwards, D. A. Whittaker, Department of Mines and Technical Surveys, Ottawa, Ont., Canada

4 p.m.—Light Metals Session

The Effects of Centrifugal Force on Substructure of Aluminum Alloy 356 + Be Permanent Mold Castings—A. J. Iler, Northrop Corp., Norair Div., Hawthorne, Calif.

Influence of Mold Variables on Fluidity of Aluminum; Doubling Casting Ductility by Fluidity Control—M. C. Flemings, F. R. Mollard, H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

Magnesium-Silver—Rare Earth—Zirconium Casting Alloys—D. L. Whitehead, Magnesium Elektron Ltd., Manchester, England

4 p.m.—Safety, Hygiene and Air Pollution Session

Foundry Air Pollution in the San Francisco Bay Area—B. Linsky, G. Aase, Bay Area Pollution Control District, San Francisco

Control of Dusts and Solvent Vapors from Shell Molding Operations—E. B. Henby, National Dust Collector Corp., Chicago.

Motion Picture—It's Up to You—National Society for the Prevention of Blindness, New York

4 p.m.—Sand Session

Granular Movement During Squeezing—D. C. Williams, Ohio State University, Columbus, Ohio

A Systematic Approach to Sand Design and Control, Effect of Mulling—G. J. Vingas, A. H. Zrimsek, Magnet Cove Barium Corp., Arlington Heights, Ill.

8 p.m.—Sand Shop Course

The Most Important Green Sand Properties—W. D. Emmett, Los Angeles Steel Casting Co., Los Angeles. A. A. Belusko, Electric Steel Foundry Co., Portland, Oreg.

8 p.m.—Pattern Shop Course

The Application and Working Characteristics of Hard and Soft Plasters—M. K. Young, U. S. Gypsum Co., Chicago

Motion Picture—Industrial Tooling and Patternmaking with Plaster

TUESDAY, MAY 9

8:30 a.m.—Registration opens (to 5:30 p.m.)

9:30 a.m.—Brass and Bronze Session

The Vertical Gating of Bronze Valves in Shell Molds—F. E. Murphy, G. J. Jackson, R. A. Rosenberg, Walworth Co., S. Braintree, Mass.

Correlation of Physical Properties and Void Volume of Copper-Base Alloys with Morphology of Solidification—Brass and Bronze Research Progress Report—R. A. Flinn, H. Kunsmann, University of Michigan, Ann Arbor, Mich.

9:30 a.m.—Light Metals Session

Melting, Casting, and Heat Treatment Techniques for Structural Uranium Alloys—G. D. Chandley, D. G. Fleck, Watertown Arsenal, Watertown, Mass.

Centrifugal Casting of Aluminum-Uranium Alloys—N. E. Daniel, E. L. Foster, R. F. Dickerson, Battelle Memorial Institute, Columbus, Ohio

A New Type Light Weight Cellular Metal—L. Polonsky, S. Lipson, H. Markus, Frankford Arsenal, Philadelphia

9:30 a.m.—Malleable Session

Casting and Annealing Heavy White Iron Sections. Malleable Research Progress Report — R. W. Heine, T. W. Mueller, J. W. Widmeyer, University of Wisconsin, Madison, Wis.

Shooter, Ceroxide or Slag—C. A. Sanders, American Colloid Co., Skokie, Ill.; Hans Heine, Malleable Founders Society, Cleveland; R. F. Marande, Ohio Malleable Div., Dayton Malleable Iron Co., Columbus, Ohio

9:30 a.m.—Pattern Session

Design and Engineering of Hot Core Boxes—E. E. Harkess, Cleveland Foundry, Ford Motor Co., Berea, Ohio

Aluminum Pattern Castings—W. E. Sicha, Aluminum Co. of America, Cleveland

12 noon—Brass and Bronze Round Table Luncheon

Problems of Running a Bronze Foundry in 1961—L. H. Durdin, president, Dixie Bronze Co., Birmingham

12 noon—Pattern Round Table Luncheon

Judging Apprentice Contest Patterns — G. E. Garvey, Garvey Pattern & Mfg. Co., South Bend, Ind.

2 p.m.—Gray Iron Session

The Dwight Lloyd McWane Process for Making Foundry Iron—T. E. Ban, C. D. Thompson, McDowell Co., Cleveland; B. W. Worthington, McWane Cast Iron Pipe Co., Birmingham

The Use of Calcium Carbide in Acid Cupolas—R. Schulze, Knapsack-Griesheim A. G., Knapsack bei Koln, West Germany

2 p.m.—Industrial Engineering and Cost Session

Report on Casting Survey, Industrial Engineering and Cost Committee—J. A. Westover, Westover Corp., Milwaukee

Motion Picture—Establishing Work Standards by Sampling—Introduction by E. C. Keachie, University of California, Berkeley, Calif.

2 p.m.—Light Metals Session

Initial Bubble Test for the Determination of Hydrogen Content of Molten Aluminum Alloys—D. J. Neil, A. C. Burr, Aluminium Laboratories Ltd., Kingston, Ont., Canada

Supercooling Measurements and Grain Size Control in Light Alloys—V. B. Kurfman, Dow Metal Products Co., Midland, Mich.

Phosphorus Refinement of Hypereutectic Aluminum—Silicon Casting Alloys—F. L. Arnold, J. S. Prestley, Reynolds Metals Co., Richmond, Va.

2 p.m.—Sand Session

A Microscopic Study of the Bonding of Steel Foundry Sands by Clay—J. B. Caine, consultant, Cincinnati, E. H. King, J. S. Schumacher, the Hill & Griffith Co., Cincinnati

A Systematic Approach to Sand Design and Control, Dry Properties of Clay Bonded Sand—G. J. Vingas, A. H. Zrimsek, Magnet Cove Barium Corp., Arlington Heights, Ill.

Precision in the Foundry—A. Short, Rolls-Royce Ltd., Derby, England. Officially sponsored paper from the Institute of British Foundrymen, London

4 p.m.—Gray Iron Session

Influence of Inoculation on the Structure of Gray Iron at Various Equivalences—Gray Iron Research Progress Report—H. D. Merchant, L. E. Toriello, J. F. Wallace, Case Institute of Technology, Cleveland

Progress of Solidification in Innoculated and Uninoculated Gray Iron—Gray Iron Research Progress Report—H. D. Merchant, J. F. Wallace, Case Institute of Technology, Cleveland

4 p.m.—Light Metals Session

Premium Quality Magnesium Sand Castings—K. E. Nelson, Wellman Bronze & Aluminum Co., Bay City, Mich.

Progress in High-Strength Alloy Castings for Airframes—W. A. Bailey, E. N. Bossing, Douglas Aircraft Co. Inc., Santa Monica, Calif.

Investment Cast Properties of Four Magnesium Base Alloys—K. Herrick, Arwood Corp., Tilton, N. H.

4 p.m.—Malleable Session

As-Cast Compact Graphite in Cast Iron—Malleable Research Progress Report—R. W. Heine, T. W. Mueller, University of Wisconsin, Madison, Wis.

Influence of Some Trace Elements on the Graphitization Kinetics of Malleable Irons—G. Sandoz, B. F. Brown, Naval Research Laboratory, Washington; W. A. Pennington, University of Maryland, College Park, Md.

4 p.m.—Steel Session

Use of the Betatron for Radiographic Examination of Heavy Section Castings—L. Venne, Electric Steel Foundry Co., Portland, Oreg.

Radiography of Cast Nuclear Components by Means of Kilocurie Cobalt Sources—R. Lent, Pacific Southern Foundries Inc., Long Beach, Calif.

Relation of Stress Rupture Properties of Cast 30 Per Cent Chromium—20 Per Cent Nickel Stainless Steel to Composition and Carbide Habit—E. P. Sadowski, International Nickel Co., Research Laboratory, Bayonne, N. J.

Use of Direct Reading Spectrograph for Analyzing Castings—E. Mang, Electric Steel Foundry Co., Portland, Oreg.

8 p.m.—Gray Iron Shop Course

Materials and Chemical Control in Cupola Operation—H. E. Henderson, Lynchburg Foundry Co., Lynchburg, Va.

8 p.m.—Sand Shop Course

Furfural Binders in the Foundry—W. H. Buell, Aristo Corp., Detroit

WEDNESDAY, MAY 10

8:30 a.m.—Registration Opens (to 5:30 p.m.)

9:30 a.m—AFS Annual Business Meeting

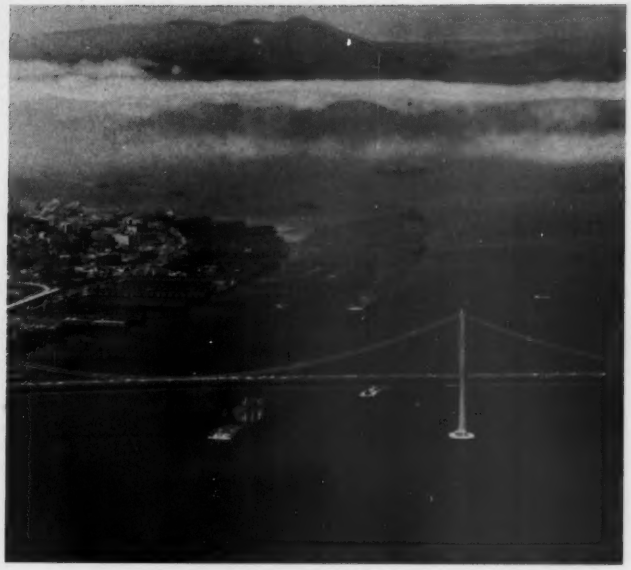
Presiding—AFS President Norman J. Dunbeck. President's annual address. Election of officers and directors. Apprentice contest awards. Presentation of AFS Awards of Scientific Merit and Service Awards

10:30 a.m.—Charles Edgar Hoyt Memorial Lecture.

Subject: *Cast Metals and Cast Shapes*—J. B. Caine, consultant, Cincinnati

12 noon—Joint Ductile, Gray, and Malleable Iron Round Table Luncheon

The Foundry's Place in Our Future Economy—



Flotilla of ships of the U. S. Navy entering San Francisco's harbor

B. L. Simpson, National Engineering Co., Chicago

12 noon—Light Metals Round Table Luncheon

The Manufacture and Use of Premium Quality Light Alloy Castings as High Integrity Structural Components—Panel: J. H. Rizley, Convair Div., General Dynamics Corp., Pomona, Calif.; R. A. Zuech, Rocketdyne Div., North American Aviation Inc., Canoga Park, Calif.; W. A. Bailey, Douglas Aircraft Corp., Santa Monica, Calif.; A. H. Peterson, Lockheed Aircraft Corp., Sunnyvale, Calif.; T. E. Piper, Convair Div., General Dynamics Corp., LaJolla, Calif.

2 p.m.—Industrial Enginering and Cost Session

Cost Control Through Application of Process Control—C. E. Haney, Esco Corp., Portland, Oreg.

Developing Standard Times for Use in the Job Foundry—D. L. Raphael, Pennsylvania State University, University Park, Pa.

2 p.m—Plant and Plant Equipment Session

Maintenance Materials Inventory Control and Materials Disbursing Systems—K. M. Smith, Caterpillar Tractor Co., Peoria, Ill.

2 p.m.—Steel Session

Design Problems in Missile Castings—R. G. Bassett, Boeing Airplane Co.,

Challenge or Compromise with Aircraft—Missile Steel Castings—S. A. McCarthy, McDonnell Aircraft Corp., St. Louis

Horizon Requirements for Castings—S. R. Carpenter, Convair, Div. of General Dynamics Corp., San Diego, Calif.

High-Strength Structural Steel Castings for Aerospace Applications—by W. R. Roser, Northrop Corp., Norair Div., Hawthorne, Calif.

Report on the AMC Steel Casting Program to Obtain High-Quality High-Strength Steel Castings for Aircraft and Missile Applications—Y. J. Elizondo, Vought Aeronautics, Div. of Chance Vought Aircraft, Dallas, Tex.

3 p.m.—Die Casting and Permanent Mold Session

Maximizing Soundness in Aluminum Die Castings—L. M. Elijah, George Sall Metals Co., Philadelphia

Fundamental Mechanical and Thermal Aspects of Die Casting—A. B. Draper, Pennsylvania State University, University Park, Pa.

4 p.m.—Gray Iron Session

Some Factors Affecting the Chill Behavior of a Roll-Type Cast Iron—R. W. Lindsay, K. E. Pinnow, Pennsylvania State University, University Park, Pa.

Development of Engine Castings by Experimental Stress Analysis—L. A. Grotto, International Harvester Co., Melrose Park, Ill.

4 p.m.—Sand Session

Progress Report, Castings Defects Handbook Revision Committee (8-S), Sand Division—G. W. Anselman, chairman, St. Charles, Ill.

4 p.m.—Steel Session

Press Forging of High-Alloy Steel Castings—T. Watmough, J. T. Berry, P. R. Gouwens, Armour Research Foundation of Illinois Institute of Technology, Chicago

Development of Foundry Procedures for High-Integrity Steel Castings—R. J. Ely, J. E. Fries, American Brake Shoe Co., Mahwah, N. J.

Procurement of GSE Missile Castings—L. W. Smith, Symington-Wayne Corp., Depew, N. Y.

7 p.m.—AFS Annual Banquet

Presiding—AFS President Norman J. Dunbeck. Presentation of AFS Gold Medal Awards

THURSDAY, MAY 11

8:30 a.m.—Registration Opens (to 5:30 p.m.)

9:30 a.m.—Die Casting and Permanent Mold Session

Factors Influencing the Design of Permanent Molds—J. Wall, Permanent Mold Die Co., Detroit

Tilt Pouring Permanent Mold Castings—G. W. Stahl, Stahl Specialty Co., Kingsville, Mo.

Aluminum Furnace Refractories—C. H. Schweinsberg, J. L. Dolph, Harbison-Walker Refractories Co., Pittsburgh

9:30 a.m.—Ductile Iron Session

Reliability of Magnesium Analysis as a Criterion of Ductile Iron Quality—Report of Ductile Iron Research Committee—A. H. Rauch, Deere & Co., Moline, Ill., H. G. Haines, Woodruff & Edwards Inc., Elgin, Ill.

Graphite Structures in Heavy Castings of Nickel Alloyed Austenitic Ductile Iron—I. Karsay, R. D. Schelleng, International Nickel Co., Bayonne, N. J.

9:30 a.m.—Fundamental Papers Session

Structure in Rapidly Solidified Alloys — P. E. Brown, C. M. Adams Jr., Massachusetts Institute

of Technology, Cambridge, Mass.

Grain Refinement of Steel Castings and Weld Deposits—G. K. Turnbull, D. M. Patton, G. W. Form, J. F. Wallace, Case Institute of Technology, Cleveland

Solidification Studies on Steel Castings and Ingots—M. C. Flemings, R. V. Barone, S. Z. Uram, H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

9:30 a.m.—Steel Session

Meeting the Challenge of Controlling Quality—L. S. Krueger, Pelton Steel Casting Co., Milwaukee

Factors Affecting Metal-Mold Reactions—G. A. Colligan, United Aircraft Corp., East Hartford, Conn., L. H. VanVlack, R. A. Flinn, University of Michigan, Ann Arbor, Mich.

A Test Program for Improving the Performance of Ladle Refractories—P. J. Neff, J. J. Downs, J. T. Baker, American Steel Foundries, E. Chicago, Ind.

Feeding Distance of Bars in Investment Molds—H. Present, Arwood Corp., Brooklyn, N. Y., H. Rosenthal, Frankford Arsenal, Philadelphia

Panel: C. M. Adams Jr., Massachusetts Institute of Technology, Cambridge, Mass., E. M. Broad, Hitchiner Mfg. Co., Milford, N. H.

12 noon—Die Casting and Permanent Mold Round Table Luncheon

Metals in Space, J. C. McDonald, Lockheed Missile & Space Div., Lockheed Aircraft Corp., Sunnyvale, Calif.

12 noon—Steel Round Table Luncheon

Steel Research Progress Reports: *Sources and Prevention of Nonmetallic Macroinclusions in Cast Steel*—R. A. Flinn, W. B. Pierce, L. H. Van Vlack, University of Michigan, Ann Arbor, Mich.; *Evaluation of Refractories as Sources of Macroinclusions*—L. H. VanVlack, J. E. Brokloff, R. A. Flinn, University of Michigan

2 p.m.—Sand Session

Core Production in "Hot Boxes" at the Renault Works—P. Jasson, Renault, Billancourt Seine, Paris, France

Jolt Impact as a Measurement of Sand Toughness—T. E. Barlow, International Minerals & Chemical Co., Skokie, Ill., H. W. Dietert, H. W. Dietert Co., Detroit

The Effect of Median Grain Size on the Properties of Green Sand—A. B. Draper, Pennsylvania State University, University Park, Pa., H. A. Knappenberger, North Carolina State University, Raleigh, N. C.

2 p.m.—Symposium on Vacuum Melting and Casting, Sponsored by Steel Division and Fundamental Papers Committee

Vacuum Casting Techniques—W. A. Matejka, Kelsey Hayes Co., Utica, N. Y.

Specialty Melting as a Service Function in a Research Laboratory—W. F. Moore, General Electric Co., Research Laboratory, Schenectady, N. Y.

Quality Requirements of Alloys for Use in Vacuum Induction Melting—T. F. Kaveney, Union Carbide Metals Co., Cleveland.

Effect of Sulphur and Carbon on Tensile Properties of Vacuum-Cast High-Strength Steel—J. B. Dabney, American Brake Shoe Co., Mahwah, N. J.; M. C. Flemings, H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

300 *Kilowatt Induction Melting and Degassing Installation*—O. E. Erickson, Hanford Foundry Co., San Bernardino, Calif.

Some Theoretical and Practical Considerations in Vacuum Induction Melting Uranium Alloys—P. S. Schaffer, Watertown Arsenal, Watertown, Mass.

Ladle Degassing for Foundry Use—H. S. Philbrick, John Mohr & Sons, Chicago

3 p.m.—Die Casting and Permanent Mold Session

Inclusions in Aluminum Alloy Castings—J. M. Fox, Aluminum Co. of America, Cleveland

Impurities in Aluminum Alloys for Die and Permanent Mold Castings—D. L. Colwell, R. J. Kissling, Apex Smelting Co., Cleveland

Iron: The Problematic Factor in the Quality of Aluminum Alloy Die Castings—W. Bonsack, Aluminum & Magnesium Inc., Sandusky, Ohio

4 p.m.—Ductile Iron Session

Classification of Graphite Forms in Nodular or Ductile Irons—C. K. Donoho, American Cast Iron Pipe Co., Birmingham

Effect of Chemical Composition on Graphite Structures in Heavy Ductile Iron Castings—I. Karsay, R. D. Schelleng, International Nickel Co., Bayonne, N. J.

6 p.m.—AFS Alumni dinner

8 p.m.—Ductile Iron Shop Course

Raw Material, Melting and Controls for the Production of Ductile Iron.—H. W. Ruf, Grede Foundries Inc., Milwaukee

8 p.m.—Gray Iron Shop Course

How to Make Different Irons from a Single Cupola Heat—H. H. Wilder, Vanadium Corp. of America, Chicago

FRIDAY, MAY 12

8:30 a.m.—Registration Opens

9:30 a.m.—Ductile Iron Session

The Formation of Flake, Spheroidal, Film and Compact Graphite During Solidification of Cast Iron—C. R. Loper Jr., R. W. Heine, University of Wisconsin, Madison, Wis.

Post Inoculation of Ductile Iron—W. C. Jeffrey, McWane Cast Iron Pipe Co., Birmingham, H. D. Bradshaw, University of Alabama, University, Ala.

9:30 a.m.—Die Casting and Permanent Mold Session

Die Casting Trim Die Procedure—D. Hannah, Hamco Products, Warren, Mich.

Porosity in Zinc Die Castings—G. P. Lewis, D. A. Craw, R. C. Bell, Consolidated Mining & Smelting Co. of Canada Ltd., Trail, B. C.

9:30 a.m.—Fundamental Papers Session

Comprehensive view of San Francisco as it faces the Bay and the Golden Gate

An Experimental and Quantitative Evaluation of the Fluidity of Aluminum Alloys—M. C. Flemings, E. Niiyama, H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

Heat Extraction from External Corners of Metal Castings—K. H. Coats, University of Michigan, Ann Arbor, Mich.

9:30 a.m.—Sand Session

A Systematic Approach to Sand Design and Control, Wood Flour—A. H. Zrimsek, G. J. Vingas, Magnet Cove Barium Corp., Arlington Heights, Ill.

A Systematic Approach to Sand Design—Interpretation of Data—A. H. Zrimsek, G. J. Vingas, Magnet Cove Barium Corp., Arlington Heights, Ill.

The Carbon Dioxide Process—G. D. Haley, Waimet Alloys Co., Detroit, J. L. Leach, University of Illinois, Urbana

9:30 a.m.—Steel Session

Improve Fatigue Life of Steel Castings by Controlled Gas Atmosphere Heat Treatment—R. D. Block, Barber-Colman Co., Rockford, Ill.

Rapid Gas Heating Techniques for Centrifugally Cast Steel Cylinders—A. Ayvazian, Rodman Laboratory, Watertown Arsenal, Watertown, Mass.

High Alumina Roofs for Electric Arc Furnaces—R. E. Gray, Texas Steel Co., Fort Worth, Tex.

Rapid Desulfurization to 0.002 Per Cent Sulfur—E. J. Dunn Jr., Crucible Steel Co., Pittsburgh

A Flux-Cored CO_2 Welding Process for Repairing Steel Castings—M. B. Prisuta, National Cylinder Gas Div., Chemetron Corp., Chicago

● Proceedings at all of these technical sessions will be reported on clearly and fully in the June and July issues of FOUNDRY. Reports will be prepared by FOUNDRY's staff of full-time editors, who will be on the scene at every session, to get the news as it happens.

Eight Picked for AFS AWARDS

Honors will be conferred on eight men during the coming AFS Congress in San Francisco. Awards of Scientific Merit and Service Citations will be presented at the business meeting on May 10. Gold Medal presentations will be made at the annual banquet to be held that evening

SCIENTIFIC MERIT

T. R. Schroeder

THEODORE R. SCHROEDER, foundry superintendent, Pontiac Motor Div., General Motors Corp., Pontiac, Mich., will receive an award of scientific merit "for notable contributions to AFS and the foundry industry in the development of a revolutionary process for the production of cores, and new concepts of automated molding and aluminum processing." Mr. Schroeder has been associated with General Motors since 1937 when he joined the Central Foundry Division in Saginaw. He was transferred to the division's Defiance, Ohio, plant in 1951 and became factory manager in 1953. He has been superintendent of the Pontiac foundry since August, 1955.

H. J. Weber

HERBERT J. WEBER, director of the safety, hygiene and air pollution control program for AFS, will receive an award of scientific merit "for exceptional services to the society and foundry industry in directing the program for the betterment of the industrial community." Mr. Weber holds degrees from DePaul University, Chicago, and from Lewis Institute, Chicago, now Illinois Institute of Technology. He entered the field of industrial hygiene as chief industrial hygienist with American Brake Shoe Co. He has written extensively on the subject and for a time was editor of the *American Industrial Hygiene Journal.*

H. E. Henderson

HARVEY E. HENDERSON, technical director, Lynchburg Foundry Co., Lynchburg, Va., will receive an award of scientific merit "for valuable contributions to metallurgical research in the casting of gray iron and ductile iron." Mr. Henderson holds bachelor of science and master of science degrees in chemical engineering from Virginia Polytechnic Institute. Before joining the Lynchburg company in 1947 he had been identified with industrial and maritime activities. With Lynchburg he has served as metallurgist, project engineer in the research department, and was appointed to his present position of technical director in 1959.

GOLD MEDAL

WILLIAM S. PELLINI, superintendent, Metallurgy Div., U. S. Naval Research Laboratory, Washington, will receive the John A. Penton Gold Medal "for exceptional contributions to the science of metal casting through leadership in fundamental research . . . particularly in the field of heat transfer and flow of metals." A graduate of Carnegie Institute of Technology in 1940, Mr. Pellini has devoted his entire career to research in the field of metals. Recently he received the Navy Distinguished Civilian Service Award for his work in metallurgical research.

Wm. S. Pellini

MERTON C. FLEMINGS JR., assistant professor of metallurgy, Massachusetts Institute of Technology, Cambridge, Mass., will receive the Peter L. Simpson Gold Medal "for outstanding contributions to the castings industry in the application of basic research to production of quality castings, particularly in the light metals field." Professor Flemings is an MIT graduate. He returned to teach after two years as a foundry metallurgist with American Brake Shoe Research Laboratory, Mahwah, N. J. He has been active in committee work of various divisions of the AFS.

Prof. M. C. Flemings

SERVICE CITATION

Jess Toth

JESS TOTH, vice president, sales, Harry W. Dietert Co., Detroit, will receive a service citation "for his dedication to the principles of AFS and long, continuous service to the society and the castings industry, particularly in the field of education." Mr. Toth attended the Detroit Institute of Technology and in 1934 joined the Dietert company. He served as secretary and sales manager from 1954 until his election as vice president in 1960. He has been active in the work of the Education Division of the American Foundrymen's Society since 1951 and currently is chairman of the Executive Committee of the Education Division.

K. M. Smith

KENNETH M. SMITH, maintenance manager, Caterpillar Tractor Co., Peoria, Ill., will receive a service citation "for noteworthy contributions to the society and the metal casting industry in the development of engineering principles to make the foundry 'a better place to work.'" Mr. Smith is a mechanical engineering graduate of the University of Illinois. His entire career has been with Caterpillar, progressing from engineering trainee through the plant engineering staff to foundry engineer—a post he held for 12 years—and the general offices plant engineering staff. He was named maintenance manager of the company two years ago.

A. D. Barczak

ALEXANDER D. BARCZAK, operational vice president, Superior Foundry Inc., Cleveland, will receive a service citation "for outstanding and inspirational encouragement to young men to foundry careers, and for constant willingness to help the other fellow." Mr. Barczak, a graduate of the University of Detroit, worked as a co-op student at Chevrolet Gray Iron Foundry, Saginaw, Mich., and continued there until 1942. Joining Bardes Forge & Foundry Co., Cincinnati, he advanced to plant manager and vice president. Mr. Barczak has been with Superior since 1948, first as plant manager, and for the last two years as operational vice president.

Pacific Brass Foundry cast this covered wagon scene in bronze for Western Bank & Trust Co., San Francisco. It is 7 ft high by 25 ft long and weighs a ton

Gold Rush Spurred Growth of

CALIFORNIA FOUNDRIES

Many types of foundries were born during California's early days to meet the needs of goldseekers and the settlers who followed them. Some of the early foundries still exist

By HAROLD E. HENDERSON

● SINCE THE ADMISSION of California to the Union in 1850, the progress the state has enjoyed has been heralded in glowing terms. The needs of an expanding population attracted artists, artisans, and scientists in almost every field of human endeavor.

Foundrymen came soon after the gold discovery and produced every imaginable shape in iron and brass that might help the miner extract his precious metal.

The industrial climate of a particular area usually is reflected in the growth or decline of its foundries. At least, that correlation has occurred in most parts of the country, and especially in California.

After the rapid, varied influx of settlers, many industries enjoyed, or suffered, a mushroom growth, and many types of foundries were born to meet their demands. The need for castings moved rapidly—from mining machinery to railroads, lumbering, agriculture, and architecture. Statuary and marine castings also were in demand, and brass foundries were on the scene very early in the '60s.

Donohue Was First—According to the California Historical Society, the first casting ever produced in California was molded in San Francisco in 1849 by Peter Donohue. Donohue's foundry enjoyed phenomenal growth and soon was known as the Union Iron Works. It was the largest and most important shop on the Pacific Coast for many years and produced everything from the smallest castings to large parts for locomotives and battleships.

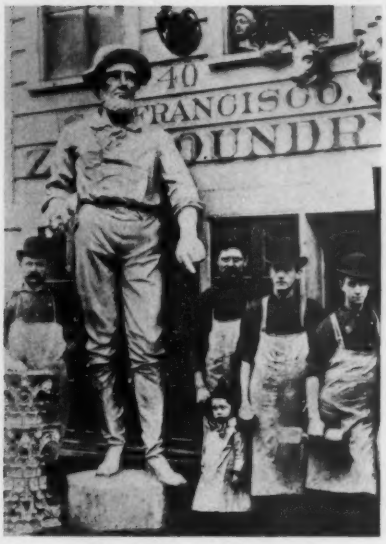
An early beginning in shipbuilding also occurred at the Mare Island Navy Yard in San Francisco Bay, which presently is constructing atomic submarines. The first naval vessel was constructed on Mare Island in 1859.

The Angels Iron Works, now known as the California Electric Steel Co., at Angels Camp, Calaveras County, probably is the oldest operating foundry in the state. It started in 1854, on iron and brass.

The Southern Pacific Railroad Co.'s foundry in Sacramento also has a long and noteworthy history. Its opening in 1869 marked the completion of the transcontinental railroad and the beginning of a new chapter in California history.

In the early '70s, this shop poured 120 tons of carwheels per day, in addition to 30 to 40 tons of gray iron locomotive and marine work, 10 to 15 tons of brakeshoes, and from 5 to 15 tons of brass journal bearings. At times it employed as many as 120 molders. At this writing it is still one of the leading shops, with production slightly below the figures listed here.

Dispersion in 1906—By 1869, more than 1000 men were employed in San Francisco foundries, and the number gradually increased until it reached its peak just prior to the



San Francisco Zinc Foundry (now known as Pacific Brass) cast this statue in 1888. It commemorates James Marshall, who first found gold in California

Peter Donohue, the first man to operate a foundry in California, is honored by a "Mechanic's Statue"

earthquake and fire of 1906. At that time, after the destruction of the city, a foundry exodus naturally occurred, and many of the old plants rebuilt in adjacent areas where land was cheaper and there was room to expand.

Joshua Hendy sought more space and extended facilities 25 miles south, in Sunnyvale. James Grahame moved his stove foundry to Newark and there made famous the name "Wedgewood." H. C. Macaulay followed the Byron Jackson Pump Co. to Berkeley (just across the bay), where it later engaged in gas and diesel engine work. Some companies rebuilt at the old sites in San Francisco, but also erected separate establishments in other parts of the state.

Foundry practice in California unquestionably paralleled that of most of the industry elsewhere. Due to mushroom growth in the wake of the gold rush, however, the situation was magnified and made even more dramatic by acute need—the demand for immediate delivery. Everything was wanted "At once!" The tempo of human activity was abnormally accelerated, and everyone was headed for fabulous wealth —or thought so.

Gold and Castings—During the 1850s, within a radius of 150 miles of San Francisco, men of all races and conditions scratched, blasted, and sluiced the earth, feverishly seeking the rainbow's end. Towns sprang up as if by magic and overflowed with seekers of golden treasure who demanded goods and services.

Erstwhile foundrymen who had been unsuccessful in their search for gold turned to the work they understood—the molding of iron and brass. In most instances, they were rewarded generously.

In the growth of a mining camp, and the development of the surrounding area, foundries inevitably appeared—at first Angel's Camp, then Sutter Creek, Tuolumne, Nevada City, Grass Valley, Stockton, and other places. Each had its foundry, which boasted of being able to produce "any mechanical contrivance capable of human conception." The sandslinger and the Caterpillar tractor first saw the light of day in Stockton, Calif. Pelton invented his water wheel at Coulterville, a mining camp, and had his first castings made in the Nevada City foundry.

North and South—Although the magnet of this feverish excitement lay in northern California, many of the unsuccessful miners soon departed for regions that seemed more promising. Some went north to Oregon and Washington, and others considered the prospects better in southern California. In those areas a newer story awaited, fully as important and as exciting as that of the gold rush. Even a synopsis of the foundry success story of the great Northwest and of Los Angeles deserves separate and special treatment and herewith is assigned to more competent historians.

Among the early brass foundries of the Bay Area which still enjoy a thriving business, three have achieved enviable reputations—namely, M. Greenberg's Sons Brass Foundry & Machine Works, Pacific Brass Foundry of San Francisco, and Kingwell Bros. Ltd. At this writing, General Metals Corp. operates one of the largest and most modern casting establishments in the area.

For many years, the DeRome Foundry, first located in San Francisco, then in Emeryville, produced much of the heroic bronze statuary which adorns our parks and other historic spots. Other shops, however, also did this sort of work. In 1888, for example, the old San Francisco Zinc Foundry (today Pacific Brass) produced the statue of James Wilson Marshall, the discoverer of gold in California, which stands at Coloma, the discovery site on the American River.

In this brief account we are forced to leave unmentioned many shops —each highly important within the sphere of its special activity. Sam Russell's Phoenix Iron Works, and Ivan Johnson's Pacific Steel Casting Co., for example, certainly are deserving of more than passing mention, but space limitations force us to conclude this look at the Bay Area's metalcasting history.

Although we have no desire to indulge in prophecy—a hazardous indulgence at best—it would seem that the future of foundry practice in California still remains golden.

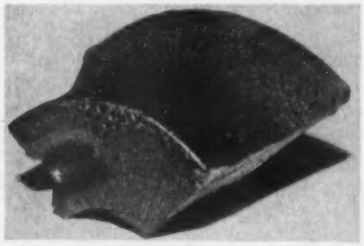
QUESTIONS and ANSWERS

Defects Are Not Identical

We are sending to you two gray iron castings, one an end shield for a small electric motor, and the other the top part of a gear shift housing. As you will observe, both show defects resembling shrink (porosity) or blowholes. Each defect shows a small ball of iron in the hole.

Castings are made from an iron containing 2.78 per cent Si, 0.122 per cent P, 0.185 per cent S, 0.63 per cent Mn, and 3.37 per cent TC. Pouring temperature is about 2750 to 2800° F. Metal charge consists of 35 to 40 per cent pig iron, 15 per cent steel scrap, and 45 per cent sprue returns and purchased scrap. Our sand has a permeability of 70 to 80, and moisture is 3 to 3½ per cent. A solution to this problem will be appreciated.

After examining the two specimens, we feel that although the defects are somewhat similar in appearance, they result from different causes. However, the exudations, or small balls of iron as you term them, which occur on the surfaces



External shrink on section of housing

of the defective areas in both emanate from the same source. It is a solidification phenomenon or characteristic of gray cast iron occurring when graphitization takes place. Graphite has a density of about one-third that of iron, and when it is precipitated there is a resultant expansion in volume of the metal.

As you know, the amount of graphite precipitation and concomitant expansion depends on the composition of the iron and the rate of solidification. They are greater in high carbon equivalence irons and with slow solidification rates. They are greatest when both conditions exist. Also, you know that liquid iron has a lower density than solid iron, a factor which results in a volume contraction as the iron changes from a liquid to solid state. Depending on a number of factors

Exudations on gear housing surface

such as feeding, solidification rate, etc., the volume contraction may appear as external or internal voids which are termed shrinkage.

Due to volume expansion resulting from graphite precipitation, gray iron castings can be underfed, or under-risered as the condition usually is described, because that expansion counteracts the volume contraction resulting from the change from liquid to solid. If the volume expansion is greater than that of contraction, the excess causes enlargement or bulging of the casting if the mold wall is soft.

When ramming is such that wall movement is prevented, the excess expansion is forced in other directions. It may be forced back into the gating system and appear as beads or exudations on the top of the riser or sprue. Again, as in these particular cases, the expansions are relieved by the exudations or beads squeezed out into voids occurring on the surfaces of the castings.

With respect to the voids appearing on the surfaces of the castings, we believe that the one on top of the section from the gear shift housing is an external shrink or draw. In our opinion, it is caused by insufficient feeding through the much thinner section beneath. The heavy section is about ¾ x 1 in. and is fed through a ¼-in. section which solidifies first and cuts off the feeding.

Remedy may be obtained through proper feeding by attaching a riser over the affected section or by increasing the solidification rate to that of the thinner section—or preferably slightly faster. That objective can be accomplished by use of a chill in the form of a rod to make the hole, a chill on the top, or a ring chill around the exterior. Thickness of the chill need not be any greater than that of the section, and its location will depend on whether machining is involved.

Appearance of the cavity in the

Motor end shield. About twice size

motor end shield leads us to the opinion that it is a blow since it shows a dull bluish surface indicative of oxidation. We suggest that you place a vent through the sand, forming the hole which extends to the surface of the mold. Also, see that the opening of the vent at the surface is not obstructed so that the gases developed can escape freely.

Alloy Is Not Trouble Maker

We are making aluminum castings for a customer who has them machined in different shops. Some of the shops are complaining about metal sticking to tools and coming off stringy. Do you have any suggestions?

Since some, but apparently not

Circle 645, Page 39→

Restore Costly Copper Components to Full Efficiency

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Foundry operators can now save thousands of dollars annually . . . dollars normally spent to replace costly copper components. Wilson Welding Company's patented process of restoring badly burned, pitted or scarred copper units to original specifications, or modified to meet your requirements, is guaranteed to perform and give life expectancy equal to that of new components.

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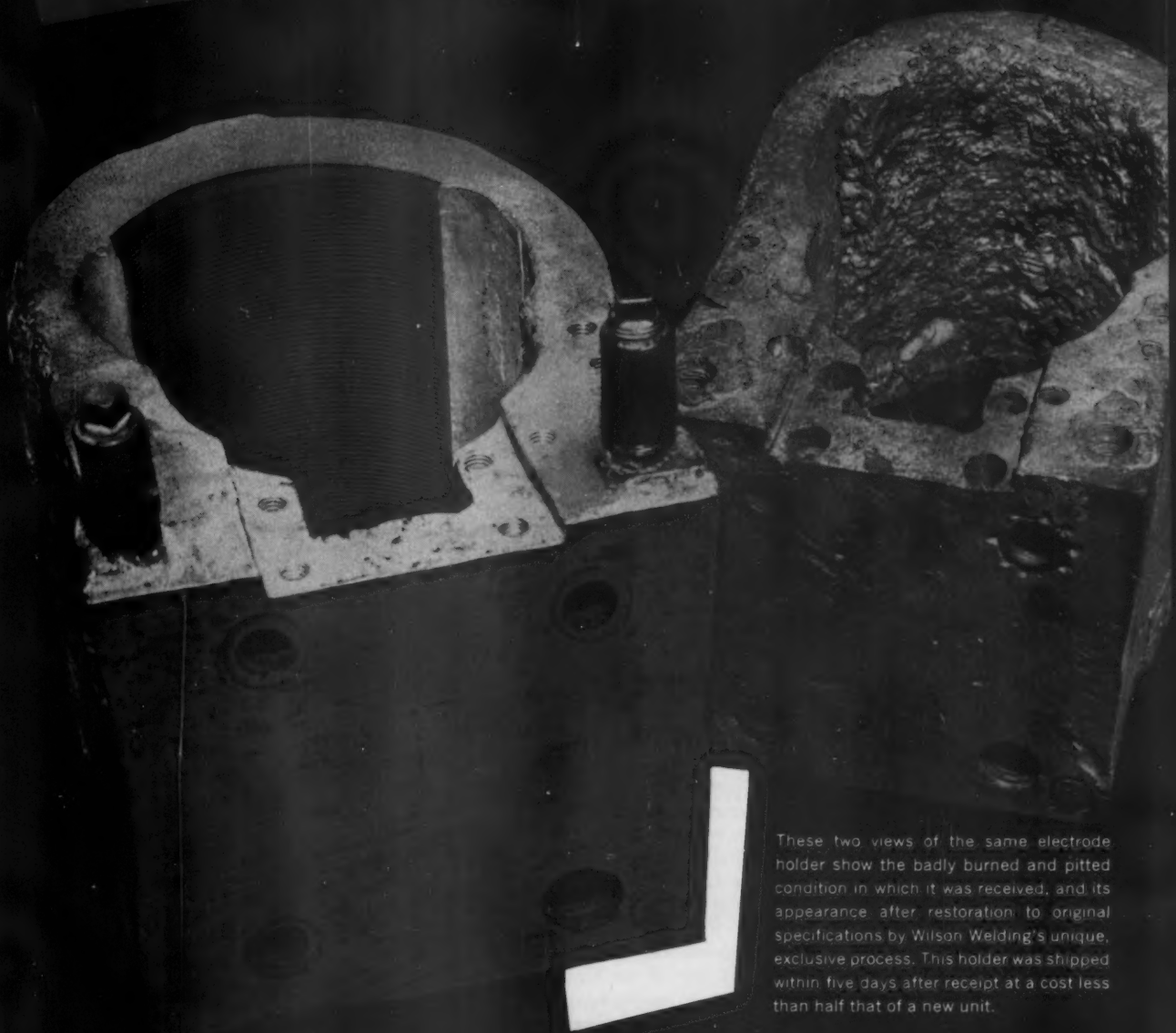

These two views of the same electrode holder show the badly burned and pitted condition in which it was received, and its appearance after restoration to original specifications by Wilson Welding's unique, exclusive process. This holder was shipped within five days after receipt at a cost less than half that of a new unit.

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all, of the shops are complaining about difficulty in machining, it appears that the trouble lies in the machining and not in the alloy. It may be that the firms having difficulty are not giving proper attention to tool grinding.

In machining aluminum alloys the cutting edges must be keen, extremely smooth, and free from imperfections. All surfaces over which the chips must pass should be lapped or hand stoned to a high finish, with the direction of finish in the direction in which the metal will flow over the tool edge and surfaces. Chips tend to cling to any tool roughness, and can be welded by the pressure and heat of cutting.

Bells Require White Iron

We are making some farm bells and are having difficulty in getting them to ring as much as we would like. The cupola mixture is composed of 40 per cent pig iron containing 2.25 per cent Si, 40 per cent machinery scrap, and 20 per cent returns. Bells are plunged into cold water while still red. We have added a small amount of nickel to the iron without results. Can you suggest any method of improving the tone of the bells?

Cast iron bells must have a structure that will not absorb or attenuate vibration, if they are to have the characteristic resonant tone. This means that the composition, which should result in white or nearly white fracture, must have considerably less silicon than your present mixture. With a ¾-in. section in the bell, the silicon should be about 0.75 per cent, but we suggest you experiment to determine the most suitable silicon content for the section thickness involved and the desired bell tone.

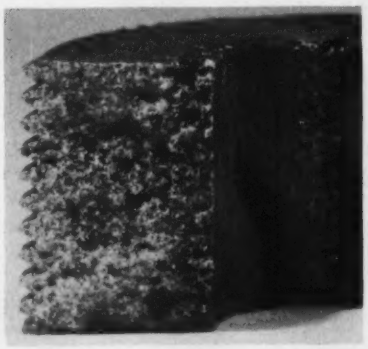
If the bells form only a small part of your daily run, and you cannot change the base metal composition, you will have to try some other expedient. Perhaps addition of ferrochromium to the ladle might produce the desired "hard" iron. Indications are that 0.67 per cent Cr will offset the effect of 1 per cent Si, so we suggest trying an addition of 0.75 per cent Cr to a ladle of your present iron and see what results are obtained.

Although quenching of bells made from your present mixture is a step in the right direction, we suggest that the practice be tried with the bells at a much higher temperature —perhaps over 1400° F. Instead of water for quenching you might try oil to prevent cracking.

Gas in Metal Produces Holes

We are sending you a small piece of brass poured in our foundry and would like to know whether you can determine the cause of the pourous condition and tell us how to eliminate it. We are having the same trouble with nearly all the different metals we pour.

Examination of the brass casting submitted indicates to us that the porous condition is caused by gassy metal. The remedy is to change your melting practice so that gas pickup is held to the minimum. The reason the holes are larger around the center opening is because the solidification rate in that area was much slower than around the outer periphery. In the process of solidification, the gas is forced from the faster cooling areas to the slower cooling, where a semi-liquid or pasty metal condition exists.



Gassy metal. About twice size

Presumably the alloy is melted in crucible furnaces, and it is suggested that you check the adjustment of the burners so that the furnace atmosphere is slightly oxidizing. That may be accomplished by reducing the oil or gas, or increasing the air.

Preferably the condition of the furnace atmosphere is determined by use of an Orsat gas analyzer, but an approximation may be obtained by inserting a piece of clean, cold slab zinc in the furnace exit for a few seconds. If soot is deposited on the zinc, the atmosphere definitely is reducing. If the zinc remains clean, the atmosphere is neutral, and if a yellowish deposit shows, the atmosphere is oxidizing. The deeper the yellow, the more oxidizing the condition is.

Phosphorus Affects Fluidity

We are interested in the effects of low phosphorus gray iron in the production of cast iron soil pipe. It has been the consensus in the past through production methods and high fluidity required in the manufacture of such pipe that high phosphorous of 0.45 per cent is necessary. Is this really needed?

So far as we know specifications for cast iron soil pipe limit only the maximum phosphorus content, generally to 0.90 per cent, presumably because high phosphorus content produces undesirable amounts of the hard, brittle constituent, steadite. No mention is made of a minimum amount.

The 0.45 per cent phosphorus figure you mention is tied in with its effect on fluidity as you indicate. Although it is true that phosphorus has an effect on promoting fluidity, careful investigation has proved that it is not nearly as potent as the effect of carbon.

Work by Evans some years ago showed that the effect of phosphorus on fluidity is about one-half that of carbon and also that carbon is three times as effective as silicon. From his investigation, Evans developed an equation or formula similar to the well known carbon equivalent formula which he called the carbon equivalent for fluidity or CEF. The complete formula is as follows:

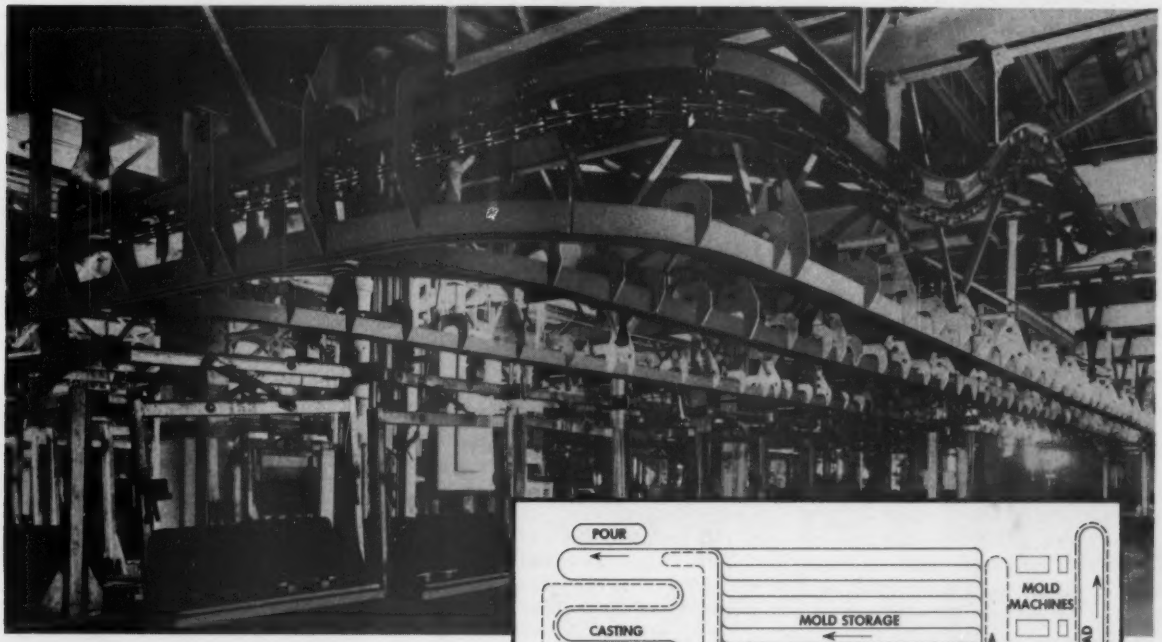
$$CEF = TC + Si/3 + P/2$$

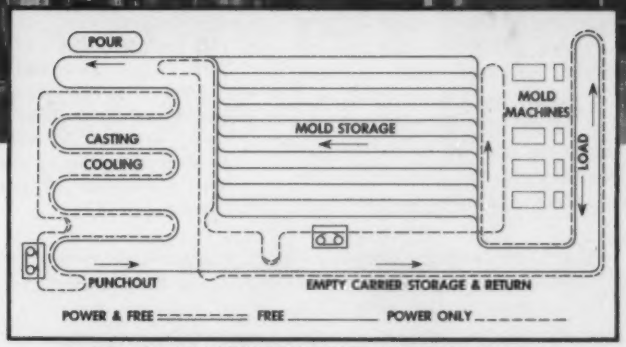
According to Evans, all cast irons with the same CEF value have approximately the same fluidity. This means that by suitable adjustment of carbon, silicon, and phosphorus content to maintain the same CEF obtained with a given composition, the fluidity will be the same.

In your case if the phosphorus is reduced from 0.45 to 0.25 per cent, an increase of 0.1 per cent in carbon or 0.3 per cent in silicon will provide the same fluidity.

Additionally, Evans studied the effect of temperature on fluidity and found that a change of about 60° F was equal to a change of 0.10 in the CEF value. This means that by temperature adjustment, it also is

ANCHOR brings advantages of "Power and Free" Conveyors to foundries





TYPICAL ANCHOR FOUNDRY "POWER AND FREE" CONVEYOR

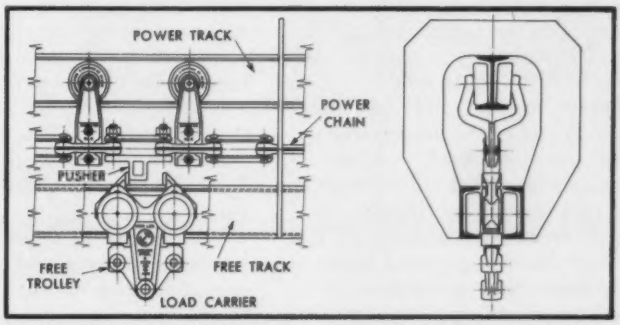
The photograph above shows the exit end of the Mold Storage section of a complete miscellaneous casting line installed in a prominent midwestern steel foundry. This system includes eleven mold storage lines, pouring, casting cooling, and empty carrier storage and return to mold machine area. In this sytem, a new Anchor retarder prevents impact and damage to the molds on the gravity storage lines.

Anchor Power and Free Conveyors combine the positive drive, fixed path features of conventional overhead trolley conveyors, with the flexibility of gravity type monorail systems. Loads can move through production steps by power, or they can be switched to gravity lines and switched back to power at any point. Carriers can be raised and lowered by lift sections in the track, rotated on turntables, or switched to meet any production requirement.

Automatic controls can be preset so that the carrier selects its own path and route through the various operations.

Anchor Power and Free Conveyors are available in several sizes for various load carrying capacities.

Because of the many layout possibilities and flexibility, we invite you to consult with our Power and Free specialists.



The Anchor Power and Free Conveyor consists of four-wheel load carrying free trolleys riding between two structural channels and pushed by a conventional overhead trolley conveyor mounted above the free track. Pusher dogs fastened to the overhead conveyor chain engage pivoted dogs on the free trolleys. When free track operation is desired, the free trolley can be switched off to one side, disengaging the pusher dog, or the power conveyor can be raised to clear the dogs on the free trolley.

ANCHOR manufactures all types of engineered floor and overhead conveyors

ANCHOR STEEL AND CONVEYOR COMPANY
CONVEYORS

DESIGNERS AND MANUFACTURERS

6906 KINGSLEY AVENUE • DEARBORN, MICHIGAN

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possible to counteract the effect of composition change. In other words, the reduction in phosphorus from 0.45 to 0.25 per cent can be overcome by increasing the iron temperature by 60° F.

Trouble With Aluminum Alloy

We are producing some castings from an aluminum-magnesium alloy containing 7 per cent Mg and are having considerable difficulty with plugging of the mica screens which are placed at the bottom of the sprue. We degas with nitrogen. We have tried increasing the size of the sprues to 1½ in. in diam to obtain a greater screen area, which gives a little greater flow into the sprue basin, but, of course, does not eliminate the plugging. The alloy appears gummy.

Your statement that the aluminum - magnesium alloy appears gummy is not a familiar one, but is suggestive of the presence of dross and oxides. Possibly you are not allowing sufficient time between the degassing operation and pouring to permit the dross and oxides to coagulate and rise to the surface where they can be skimmed off, or perhaps the skimming is not thorough.

Nitrogen degassing usually is performed at 1250 to 1300° F, and the temperature of the alloy then is allowed to rise gradually, over a period of 10 to 20 minutes, to the pouring temperature. Although nitrogen functions effectively in removal of hydrogen, it does not produce a "dry" dross which can be removed readily, and salt fluxes often are added to develop the desired dross condition. Many of those are available on the market, but care must be exercised in using those containing sodium since that element has a detrimental effect on magnesium-bearing alloys.

Although chlorine removes some of the magnesium, it appears to be preferred by many for degassing of aluminum-magnesium alloys since its use develops a dry dross through chemical as well as mechanical reactions. It may be used in gaseous or solid form such as hexachlorethane or other chlorine-bearing compounds. Because chlorine is toxic, the degassing operation should be conducted in well ventilated areas, preferably equipped with an exhaust system. Loss of magnesium in the usual degassing operation is about 0.1 per cent, which in view of the 6.2 to 7.5 per cent Mg range is minor unless the alloy is on the low side. In that circumstance, the loss can be rectified by addition of 2 oz of magnesium per 100 lb of alloy.

With reference to location of the screen at the bottom of the sprue above the basin or reservoir, it appears that you are using a straight sprue, which is conducive to turbulence and air entrainment. It is suggested you employ a tapered sprue and place the screen on the outlet side of the sprue basin. Several suitable locations for screens are shown in "Gating Aluminum Castings" by Flemings and Taylor in the April, 1960, issue of FOUNDRY.

Crack Results From Shrink

We have been having some trouble with fire extinguishing sprinkler head frames, like the samples submitted, which crack at the neck. These are made from the 85-5-5-5 alloy poured at 2100° F, and cleaned by tumbling with steel shot. The defect does not show up until after machining, and out of 1000 pieces only 35 showed the cracks.

Examination of fractured castings at the location where the cracks appear indicates that you are having shrinkage problems. The area is approximately two-thirds the thickness of the adjoining section when the core forming the hole is in the exact center. In those pieces containing cracks, however, the core was off center with the crack in the thinner section. The fracture at the crack exhibited the feathery dendritic structure associated with shrinkage.

Best remedy, of course, would be to eliminate the neck-downed portion connecting the harp or frame to the body since it serves no useful purpose. Pattern and corebox equipment should be examined to see that the prints for the cores are centered, that the prints on the cores are centered, and that the cores are round. Possibly the trouble can be alleviated by an increase in the pouring temperature.

Again, the temperature loss from beginning to end of pouring may be sufficient to cause the defect. Take temperature readings on the first and last molds poured, segregating the castings through cleaning and machining to see whether it is a factor.

Although, as you indicate, the loss on a piece basis is 3.5 per cent and does not appear too bad, it will be high on a value or cost basis. Cost of a piece discarded on shakeout is considerably less than that of a piece rejected after it has been machined.

Chemical Coats for Castings

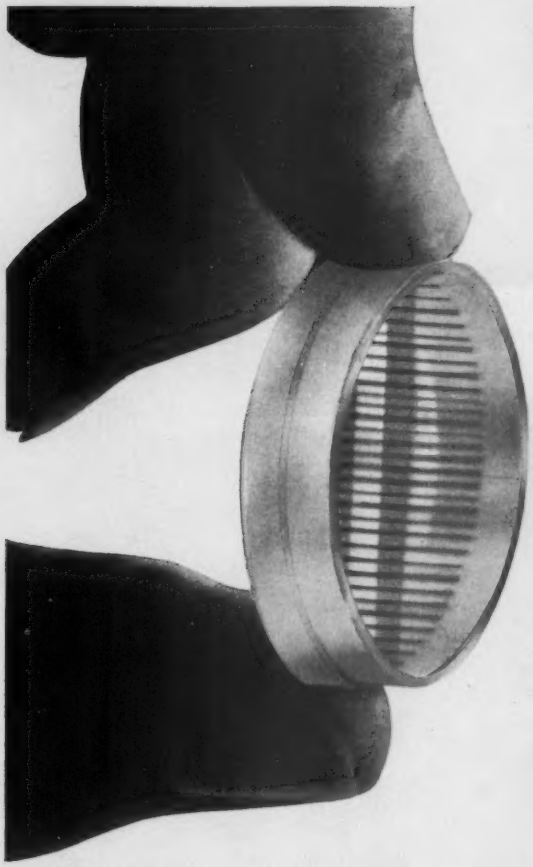
We will appreciate some information on how to anodize aluminum castings to keep them from turning dark, and how to oxidize bronze castings to darken the background on plaques before grinding the faces of the letters.

Anodizing of aluminum is accomplished by electrolytic treatment in baths containing oxalic, phosphoric, chromic, or sulfamic acids. The work is cleaned carefully, made the anode in the acid bath, and subjected to the action of direct current ranging from 5 to 60 volts, which will provide 6 to 60 amp per square foot of cathode area.

It is our understanding that most of the procedures are covered by patents, and we suggest that you get in touch with the large producers of aluminum for information.

Brown to black coloration of brass and bronze, which usually is termed oxidizing but actually is sulfidizing, is accomplished by immersing the casting in a dilute solution of ammonium polysulfide. The casting must be as clean as possible to insure uniform coloring and preferably should be degreased by use of suitable agents or by immersion in a boiling, 5 per cent solution of caustic soda for 15 minutes. Then it is rinsed thoroughly in running water and immersed for 5 minutes in a dilute nitric acid bath composed of 1 part commercial acid and 50 parts water.

After thorough rinsing in running water, the piece is immersed, preferably by a string, in a coloring bath composed of commercial 20 per cent ammonium polysulfide diluted with an equal amount of water. It is left in the bath until the desired color develops, and the piece then is dried by tumbling in sawdust. For added protection, the background coloring should be coated with clear lacquer.



ELIMINATE COSTLY CORE VENT CLEANING

TRY NON-CLOGGING, LONG-LASTING NYLON CORE VENTS ON MONARCH'S LIMITED INTRODUCTORY 30-DAY TRIAL OFFER

You can't lose. Either you save time and money with Monarch self-cleaning nylon core vents or they cost you nothing. Monarch, pioneer in developing the revolutionary nylon core vent, makes this startling offer: use the coupon below to order a sample supply of nylon core vents; if, at the end of 30 days, you have not realized a time and cost advantage over the use of metal vents, send back the unused sample vents and they cost you nothing.

Here's why Monarch can make such a liberal offer: nylon core vents can't clog, never need costly cleaning procedures because sand, oil and other binders can't adhere. Last 3 to 5 times longer than metal vents yet cost no more. Nylon core vents resist acid, oil and stains and have a melting point of 400-450°. They cut installing time too, require no time-consuming alteration to fit contoured as well as flat surfaces. Deep-slotting allows nylon vents to be contoured easily and quickly without affecting size of slot opening. Tapered "lock-in" design offers greater pressure resistance. All standard sizes from 3/16 to 1½-in.

Now join a vanguard of the largest foundries in the world (names on request) who have eliminated their tedious, expensive routines of core vent cleaning. Send for your trial order of self-cleaning Monarch nylon core vents *today!*

MAIL THIS COUPON FOR 30-DAY TRIAL OFFER

MONARCH PRODUCTS CORPORATION
960 West 122nd Street • Chicago 43, Illinois

Gentlemen:

Please send me ____ Monarch nylon core vents, size ____ in. I understand that if they do not perform as advertised—do not prove to be more economical in use than metal vents—I may return the unused amount within 30 days and my invoice will be cancelled.

Size	per 100	Size	per 100	Size	per 100
3/16 @ .05 ea.	$5.00	5/16 @ .07 ea.	7.00	7/8 @ .12 ea.	12.00
1/4 @ .06 ea.	6.00	1/2 @ .08 ea.	$8.00	1 @ .14 ea.	14.00
5/16 @ .06 ea.	6.00	3/8 @ .09 ea.	9.00	1 1/4 @ .16 ea.	16.00
3/8 @ .07 ea.	7.00	3/4 @ .10 ea.	10.00	1 1/2 @ .18 ea.	18.00

NAME _____ POSITION _____

FIRM _____

ADDRESS _____

CITY _____ STATE _____

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A Better Casting Is Born

Your foundry . . . *your* casting problem. But helping you is your Ferrocarbo* representative—it's his job to work after hours if need be, to provide whatever technical service and advice is necessary to help you make the best possible casting. He is a practical foundryman—usually a graduate metallurgist—who is expertly qualified to advise in the use of Ferrocarbo briquettes to obtain stronger, denser, more easily machinable castings. He can show you how Ferrocarbo promotes deoxidation—and why Ferrocarbo-treated iron is more fluid at lower temperatures, enabling you to reduce the number of misruns and rejected castings.

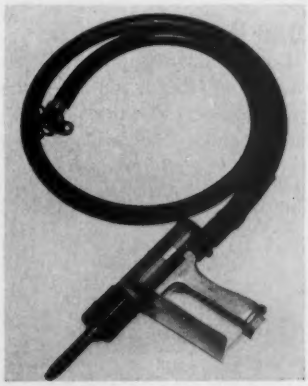
Ferrocarbo® is a product by **CARBORUNDUM**

*Ferrocarbo® distributors are Kerchner, Marshall & Company, Pittsburgh, Buffalo, Detroit, Philadelphia, Birmingham, Los Angeles, Canada; Miller and Company, Chicago, St. Louis, Kansas City, Mo., Burlington, Iowa.

New EQUIPMENT and SUPPLIES

METAL REMOVAL TORCH

Model R heavy-duty torch is designed primarily for pad washing in foundry cleaning rooms. It provides six lines of current contact through



its special alloy spring-action jaws. Concentric cable assembly provides greater current and air volume capacity. Features include a stainless steel shield and handle assembly, pistol grip, and adjusting knob for the air blast. Unit may be used with standard or jointed electrodes and is offered in three sizes to handle 3/4, 3/8, and 1/2-in. electrodes.—**Arcair Co.**, P. O. Box 431, Lancaster, Ohio.

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MECHANICAL TESTER

Model LW mechanical tester features test space 14 1/2 in. wide and a choice of test heights from 12 to 40

in. Unit is available in seven capacities from 250 lb max up to 10,000 lb max, all of which can perform tensile, transverse, compression, and shear tests on materials with tensile strength ranging up to 400,000 psi. A wide selection of gripping fixtures is available.—**W. C. Dillon & Co.**, 14620 Keswick St., Van Nuys, Calif.

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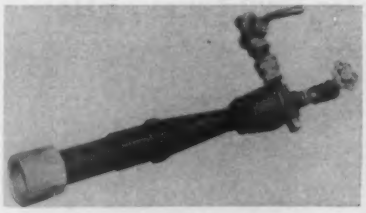
TORCH

Torch is designed for melting nonferrous metals; drying molds and cores; lighting cupolas; and heating crucibles, ladles, and pouring spouts. A handle can be provided for portable use, and mounting lugs are provided for permanent installation. Unit uses a small amount of high-pressure air at 20 to 100 psi (about 10 per cent of the total air required) to draw an equal amount of pro-



pane, butane, or natural gas into the mixer through a primary modified venturi. The main venturi of the torch entrains additional combustion air and mixes it with the gas. This mixture is delivered to the burner nozzle. Torch is available in eight sizes with heat capacity ranging from 40,000 to 3 million Btu per hr, and flame length ranges from 10 in. up to 4 ft.—**Bryant Industrial Products Corp.**, 17700 Miles Ave., Cleveland 28, Ohio.

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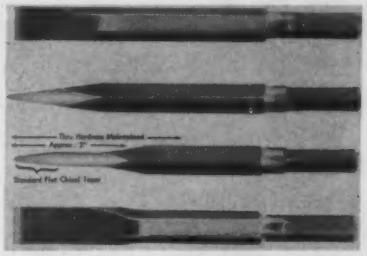
CHIPPING HAMMER CHISELS

Chisels with GP style points are for use with pneumatic chipping hammers. This is a new design which is claimed to eliminate point reforging and rehardening. Normal flat chisel cutting action is achieved because a standard flat chisel taper is provided on the front section of the blade as shown. The illustration compares a GP chisel (below) with one of regular design. High point hardness is maintained throughout the rectangular blade,



and points can be restored merely by rough grinding. Chisels are available in Bedco alloy or BTF alloy steel with either hexagon or round shank types.—**Bedford Tool & Forge Co.**, 22 Interstate St., Bedford, Ohio.

For More Details Circle No. 464—Page 39

RADIATION PYROMETER

Radiation pyrometer reportedly measures temperatures up to 4000° F with an accuracy within ±1 per cent of temperature span. High signal output of 60 mv at 2200° F permits use of an ac receiver-recorder. The ac bridge circuit in the receiver requires no standardized voltage, preamplifier, or converter. Ambient temperature compensation

is eliminated because a heating element maintains internal temperature at 250° F. Illustration shows built-

←Circle 648, Page 39

in optical sighting system which provides a visual check of correct alignment.—**Bailey Meter Co.**, 1050 Ivanhoe Rd., Cleveland 10, Ohio.

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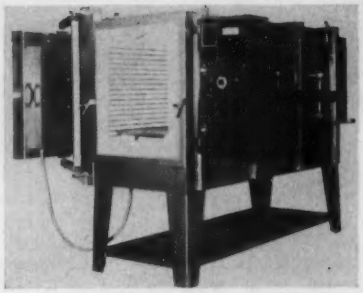
SPOT HEATERS

Electric infrared heaters are available for localized heating in outdoor areas, indoor areas where large air movements make space heating costly or ineffective, and areas where only occasional heating is required. Designed for overhead mounting, units can be installed like lighting fixtures. Various models with a choice of two types of quartz elements are offered.—**Fostoria Corp.**, Huntingdon Valley, Pa.

For More Details Circle No. 466—Page 39

ELECTRIC FURNACE

Electric furnace, Model LP-2472H, is designed for heat treating and other furnace applications. Temperature can be controlled from 300 to 2300° F; with forced convection, the range can be lowered to between 150 and 1875° F. Input controllers are used and, if desired, can be arranged to provide zone gradient control. Heating elements are supported by special holders to provide excellent heat transfer and keep overshoot and undershoot of temperature to a minimum.—**L & L Mfg. Co.**, 804 Mulberry St., Upland, Chester, Pa.



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GRINDING WHEEL

Grinding wheel, designated Radiac Type 27, features a raised hub which permits mounting and dismounting without tools. A threaded steel insert is molded as an integral part of the wheel. This assembly is backed up by a steel adapter flange to insure perpendicular mounting of the wheel on the spindle. Standard wheel diameters are 7 and 9-in. in thicknesses of 1/8, 3/16, 1/4, and 3/8 in. Arbor size is 5/8 in.-11. Other sizes of wheels or nuts are available on special order.—**A. P. de Sanno & Son Inc.**, 422 Wheatland St., Phoenixville, Pa.

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LOAD INDICATOR

Load indicator measures pressure, torque, or thrust while hydraulic cell is in any position. Gage features 6-in. diam, range from 0 to 10,000 lb in increments of 100, and an adjustable zero setting. Hydraulic cell is 6 in. in diam. Entire unit weighs less than 10 lb.—**Research Products Co.**, P. O. Box 1047, 1415 Third St. South, St. Petersburg 31, Fla.

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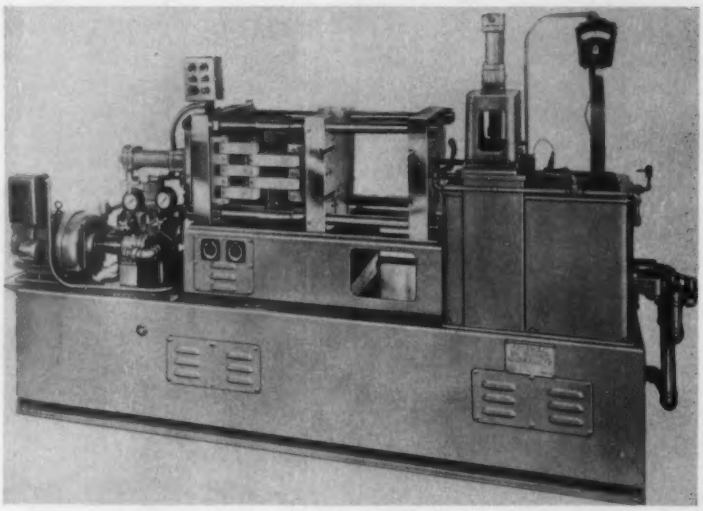
PNEUMATIC LUBRICATOR

Pneumatic lubricator, Model 606D, is an air-powered grease or oil cup designed to eliminate flow problems common to spring-loaded types. Dual metering adjustments include an air regulator to control incoming air and a small needle valve at the lubricant outlet to control flow to bearings, etc. Reservoir holds up to 16 oz of lubricant and is filled through a loader fitting.

Air tank provides air pressure up to 100 psi max, and it is recharged each time the lubricant reservoir is refilled. Tank has sufficient capacity to handle several reservoir fillings before air pressure drops

Diecasting Machine Cycles 1300 Times an Hour



Diecasting machine is said to feature developments which allow doubling the previous output of diecastings. Model 150Z, with 150-ton locking pressure, incorporates a new hydraulic combination pump which delivers 21.8 gph.

Included in the hydraulic system is valving which allows the regulation of pressures between the clamping cylinder and the shot cylinder to be isolated from each other. The safety shot die interlock also has been redesigned for greater safety.—**American Die Casting Machinery Co.**, 1744 W. Winona St., Chicago 40, Ill.

For More Details Circle No. 505—Page 39

TENZALOY

Tenzaloy Aluminum for high-strength castings without heat treatment

When you need a high-strength aluminum casting your alloy should be self-aging Tenzaloy — particularly if you want to avoid heat treatment. *Tenzaloy has this unique combination of properties:*

1. High yield and tensile strength
2. Exceptional machinability
3. Remarkable dimensional stability
4. High impact and shock resistance
5. Excellent corrosion resistance
6. Permanent, silvery-white finish

Tenzaloy castability is excellent in green sand, plaster, investment, shell, oil-bonded sand and permanent molds of all kinds. It is particularly suited to designs where load-carrying capacity, impact strength and light weight are essential, and it is used in applications where heat treated aluminum alloys, cast iron or other materials might otherwise be selected.

Write for your copy of Bulletin 103R5 to: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y.

ASARCO

For More Information Circle 649, Page 39

This man is taking an "electrode break"

Have you had this problem lately? Running short of electrodes is no fun. It's costly. Downtime always is.

Recognizing this problem, Arcair supplies electrodes *through your local dealer when you need them,* saving costly downtime.

If you want *positive assurance* you'll always have the right electrode at the right time, specify Arcair electrodes. Local stocks kept by your local Arcair dealer *guarantee* fast delivery. Any size, any type, they're as near as your phone. Call your local Arcair dealer next time you need electrodes. Arcair Company, 465 S. Mt. Pleasant Street, Lancaster, Ohio.

Arcair®

enough to require additional air. Lubricator can be manifolded to several needle valves to deliver lubricant to multiple points. Any lubricant ranging from light spindle oil to NGL14 grease can be handled. —**Pan-Tech Engineering Co.**, 3783 Richmond Ave., Houston, Tex.

For More Details Circle No. 470—Page 39

RECORDING CONTROLLERS

Line of round chart recording and indicating controllers is available for measurement, indication, control, and permanent recording of temperatures. Units are self-contained and need only an external sensing device. With proper circuitry and the use of transducers, such variables as speed, strain, pH, and other quantities which can be resolved into electrical signals can be recorded and controlled.

Design allows access for quick change of range, control form, cross chart speed, charts, and all major or adjustable components. Scale is 32 in. in circumference (standard 12-in. chart) with a calibrated width of 4⅝ in. Full-scale balance speed is 4 sec, and accuracy is 0.5 per cent of full scale. All thermocouple and radiation pyrometer ranges down to 5-mv full scale are available. Zener diode assures continuous standardization. — **Barber-Colman Co., Wheelco Industrial Instruments Div.**, Rockford, Ill.

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DUST COLLECTOR

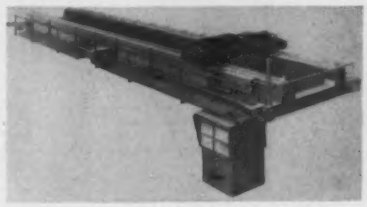
Dust collecting unit is available in two models. In addition to removing dust, it also will remove metal cutting chips from milling, shaping, and other machine tools. The 1-hp model AR15 has a capacity of 850 cfm and the two-hp model AR16 has a 1470-cfm capacity. Both models require 24 x 24 in. floor space. These units have a removable dust drawer for cleaning ease. Fan is powered by a totally enclosed motor supported on a four-post design.—**Standard Electrical Tool Co.**, 2488 River Rd., Cincinnati 4, Ohio.

For More Details Circle No. 472—Page 39

OVERHEAD CRANE

Series D overhead electric traveling cranes are available for regular industrial service in capacities ranging from 3 to 25 tons, with spans to 80 ft and equipped for floor or cab operation.

Features of these cranes include box sections for girders and end trucks, flame-hardened forged steel



wheels, and rubber bumpers on the end trucks. Drive unit, consisting of speed reducer, flange-mounted enclosed motor, and shoe-type brake, is at the center of the span and connects through cross shafts to the wheel axles. Trolley, including motors, brakes, and helical gears, is integrated into a single unit by a welded steel frame.—**Manning, Maxwell & Moore Inc., Shaw-Box Crane & Hoist Div.**, Muskegon, Mich.

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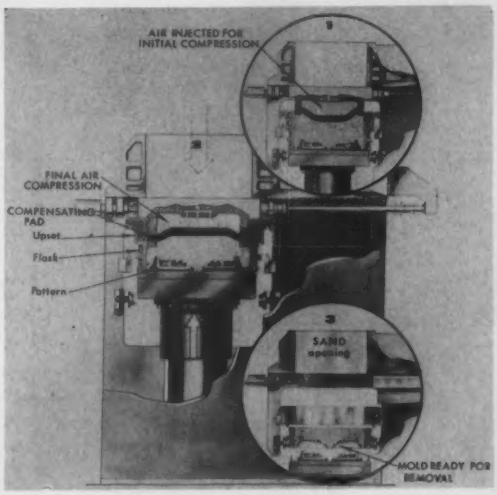
Machine Produces Uniform Mold Hardness



Automatic diaphragm molding machines are said to produce uniform, high-density molds which prevent mold wall movement or swelling. Results include improved metal structure, smaller risers, and reduced casting weight. Use of these machines is said to have made possible the casting of thin-walled gray iron precision engine block castings in green sand molds at two large automotive foundries. Casting weight variation of less than 0.5 per cent is reported to have been achieved with castings weighing 236 lb.

After flask has been filled with a measured amount of sand, the diaphragm unit is moved into place. The diaphragm, or compensating pad, from 3 to 8 in. thick depending on flask size, is molded from an abrasion-resistant synthetic compound. Its perimeter is reinforced by nylon cord. A measured amount of air is pumped into the chamber behind the pad, and the hydraulic cylinder raises the pattern to squeeze the mold.

Depending on amount of air used, pressures up to 450 psi are applied evenly to the mold, including all pockets, to make possible even deep molds with uniform hardness ratings up to 100. Use of air behind the pad prevents accidental mixing of oil with sand, and pad life of a million cycles is claimed. Machines are available for flask sizes up to 72 in. wide, 140 in. long, and 45 in. deep.—**Taccone Corp.**, North East, Pa.

For More Details Circle No. 506—Page 39

RUST INHIBITOR

Rust inhibitor, BC-32S, is a newly-developed, clear, nonoily synthetic polymer for rust protection on all ferrous and nonferrous metals. It promotes paint adhesion and stops underfilm corrosion when used in place of a primer coat. From 15 to 25 minutes are required for air drying, and temperatures up to 500° F can be used for forced drying, if necessary. Material is designed for spray or dip application and can

SETTING CORES IN DRAG HALVES as molds are conveyed to next station. Except for core setting and pouring, this new line is completely self-operating for continuous production flow.

Osborn Field Report...

HERE'S WHAT'S HAPPENING ON THE MOST PRODUCTIVE MOLDING LINE IN THE U.S.

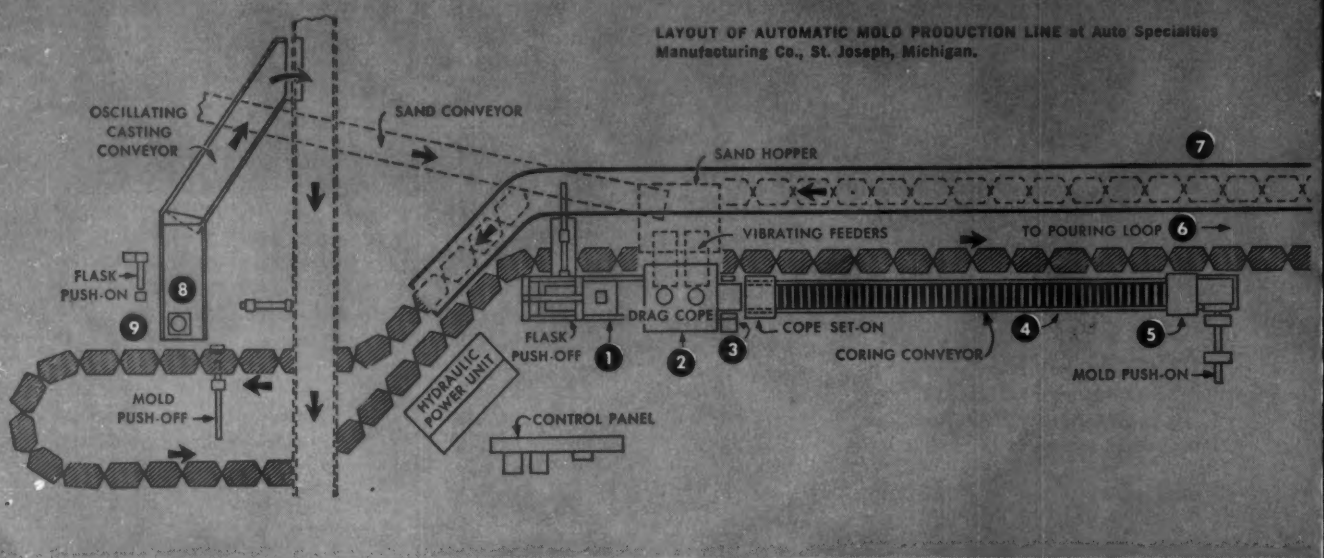
This new automatic molding line at Auto Specialties Manufacturing Co. ranks today as the nation's most productive, dependable molding operation. It features Osborn's Automatic Series "M" Molding Machine plus other Osborn-built automatic equipment for highly efficient mold and flask handling. Requiring only a minimum of manpower, its simplicity enables the new setup to run dependably hour-after-hour... shift-after-shift, turning out a continuous flow of exceptionally high quality castings of close dimensional accuracy and superior surface finish. Net result is that workers like the new line and so does management. It's on-the-job evidence that the *key* to modern foundry *profit* planning is *mechanization.*

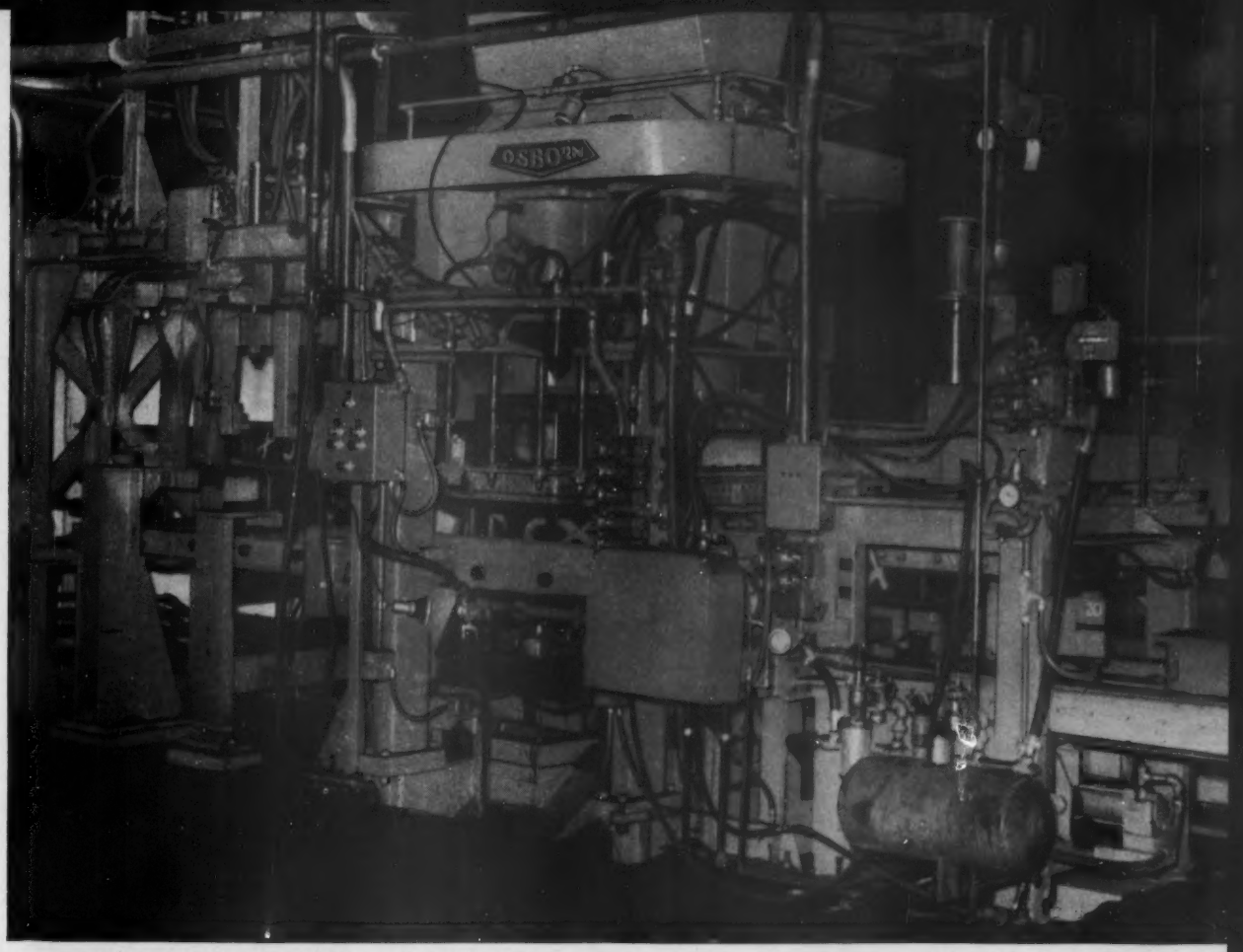
For foundrymen concerned with ways to lower costs... speed production... boost efficiency on short-run or mass production—Osborn's advanced foundry production machinery and methods are well worth checking into. Write for full information.

Osborn equipment at Auto Specialties Mfg. Co. delivers these 6 important benefits: Higher production is achieved with minimum manpower • All jobs carry the same standard rate • Variations in mold types are handled by simply varying number of core setters and pourers • Mold hardness can be changed by simple adjustments • Sand spillage is practically eliminated... reducing "housekeeping" time • No manual lifting... less exposure of workmen to injury.

HERE'S HOW IT WORKS—Assembled flasks are pushed from closed-loop conveyor car line into flask feeder at (1). Cope and drag are automatically separated and positioned in molding machine (2) for blow-fill and squeeze. As mold halves are ejected from molding machine, drag is rolled over at (3). Cores are set at (4) and molds enter closing machine at (5). Pouring is done at (6). Filled flasks move through cooling tunnel (7) to automatic punch-out station at (8). Cycle is completed as empty flasks are returned to conveyor at (9). Flasks used on the line measure 16" x 19" x 8" drag, 8" cope. Molds are rammed to a uniform hardness of 90-97 depending on job requirements.

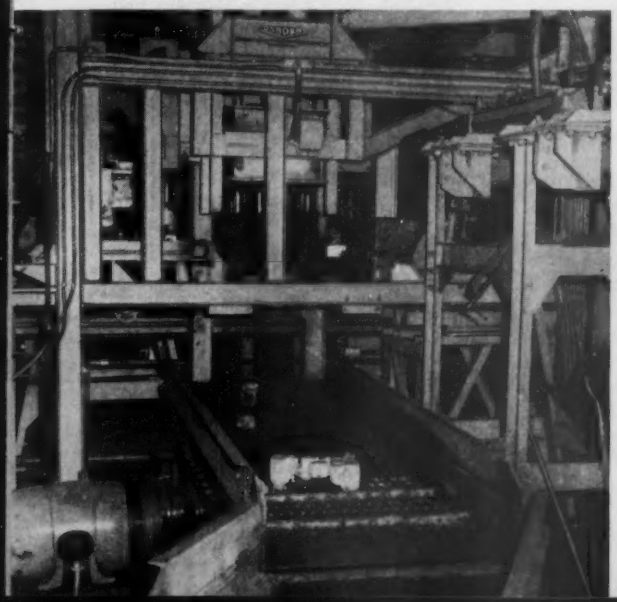
LAYOUT OF AUTOMATIC MOLD PRODUCTION LINE at Auto Specialties Manufacturing Co., St. Joseph, Michigan.





COPE AND DRAG MOLDS ARE RAMMED SIMULTANEOUSLY at a rate well over 300 per hour by Osborn Series "M" Blow-Squeeze Molding Machine on new automated molding line at Auto Specialties Manufacturing Co. Finished half molds are seen moving out of machine at right. Series "M" Molding Machines (available in 3 size ranges) are blow-fill, hydraulic-squeeze units. Entire molding sequence is automatic, on pre-set time cycles. Green sand molds are completed within 12 seconds.

OSBORN AUTOMATIC CASTING PUNCH-OUT EQUIPMENT quickly removes sand and castings . . . brushes flask walls clean . . . and eliminates practically all flask pin and bushing maintenance.



FOREIGN REPRESENTATIVES — *ARGENTINA: EISA Argentina, Buenos Aires. BELGIUM: S. A. Isbecque Todd, Brussels. BRAZIL: Equipamentos Industrias EISA, Ltd., Sao Paulo. BRITISH ISLES: J. W. Jackman & Company, Ltd., Manchester. FRANCE, ITALY: S.A. des Machines Osborn, Paris. MEXICO: Forel De Mexico, S. A., Mexico, D. F. THE NETHERLANDS: Landre & Glinderman, NV, Amsterdam. SWEDEN: S. Alexanderson & Company, A/B, Sodertalje. SWITZERLAND, FED. REP. OF GERMANY: APROTEC, S.A., Geneva. BOLIVIA: International Machinery Co., LaPaz. CHILE: International Machinery Co., Santiago. PERU: International Machinery Co., Lima.*

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Molding Machines
Shell Core Machines
Core Blowers
Metal Finishing Machines
...and Finishing Methods
Industrial Brushes

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FEMA

For More Information Circle 651, Page 39

be adapted for flow coating or roller coating. One gallon covers 1000 sq ft or more, and coating can be removed easily, if necessary.—**Surface Research Corp.**, 2901 E. Fourth Ave., Columbus 19, Ohio.

For More Details Circle No. 474—Page 39

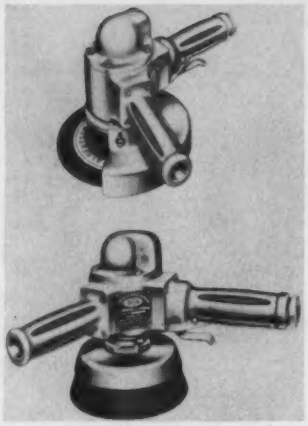
INDUSTRIAL TRUCK TIRES

Press-on tires, polyurethane for industrial trucks, are offered in smooth solid tread and cushion traction tread designs. Line includes a wide range of diameters and widths. Use of polyurethane tires is claimed to allow use of smaller wheels on fork trucks. Material permits loads up to 15,000 lb per wheel. — **American Vulko-Tread Corp.**, 8128 N. Lawndale Ave., Skokie, Ill.

For More Details Circle No. 475—Page 39

VERTICAL GRINDERS

Vertical air grinders are offered in



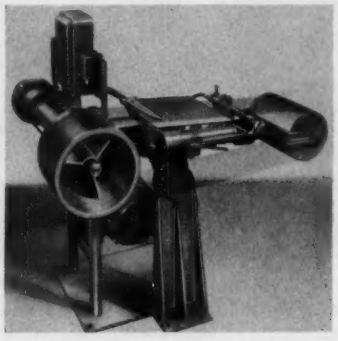
regular duty 505 series for 9-in. depressed center wheels and heavy-duty 532 series for 6-in. flared cup wheel grinder. The 505 series is available with speeds of 4500, 6000, and 7000 rpm and the 532 series with speeds of 3500, 4500, and 6000 rpm. Either tool can be operated as a depressed center wheel grinder, flared cup wheel grinder, wire brush tool, or disc sander.

Magnesium housings are used as are lever throttles with safety locks. A stainless steel ball and a replaceable valve seat of Buna N rubber are used for longer and better sealing life. Newly designed air motors provide air behind the vanes for quick starting, and sealed lower bearings are used to prevent leakage of air and lubrication.—**Albertson & Co.**, Sioux City, Iowa.

For More Details Circle No. 476—Page 39

BACKSTAND

Backstand is designed for positive belt-tracking during deburring, surfacing, grinding, and polishing. It can be driven by a lathe wheel or any other powered wheel. Unit consists of an idler roll and a special "air eye" device to prevent belt run-



offs. When heavy work pressures act to move the belt to one side or the other, the air eye signals the idler roll, which automatically corrects the position of the belt. A special platen-type working table with work stop is available to facilitate flat grinding, and the belt tension mechanism is spring controlled. Unit comes in two models for 6 and 12-in. abrasive belts; minimum belt length is 114 in.—**Murray-Way Corp.**, P. O. Box 180, Birmingham, Mich.

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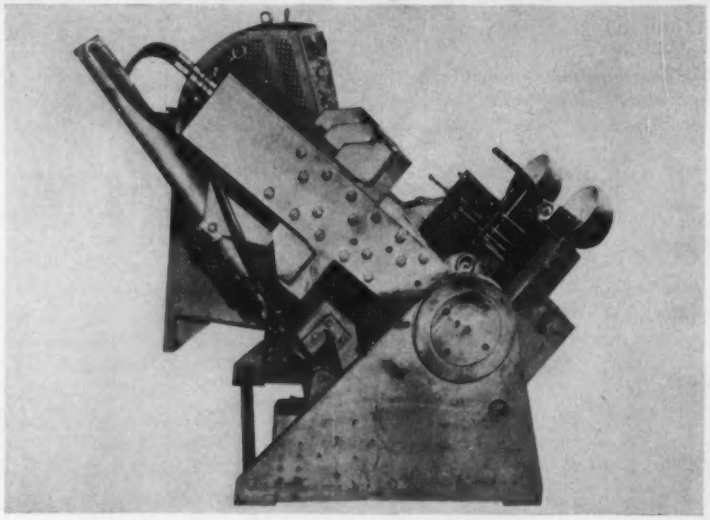
Permanent Mold Casting Unit Is Automatic



Autocast permanent mold casting machine features automatic operation. After the ladles, shown on the right of the machine, are filled with molten metal, the machine tilts to the vertical position.

As the machine tilts, metal runs down the slope into the molds, eliminating turbulence and assuring progressive solidification. The tilting cycle is adjustable to provide various rates of pouring.

After a predetermined cooling interval, the machine opens automatically and ejects the castings. This method of pouring is said to prevent flash at the bottom of the mold. The control console with adjustable timers can be seen behind the molding machine. — **Stahl Specialty Co.**, Kingsville 75, Mo.

For More Details Circle No. 507—Page 39

AFTERCOOLER

Aftercooler, Model A4VC, is built for capacities of 50 to 120 cu ft of free air per min and comes in lengths from 40⅜ in. to 95¼ in. Unit cools compressed air so that suspended water can be separated. Cooling chamber is only 4½ in. in diam. It features a copper coil through which the cooling water flows. Coil is attached to the flanged head with flared connections and is supported throughout its

CAUTION! CASTINGS...HANDLE WITH GO-DEVIL BY DROTT

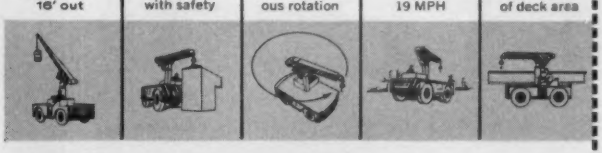
In a foundry, any damage to a casting can mean an expensive piece of scrap. That's why this foundry specifies the new 60 RM 2 Go-Devil for a large part of its handling operations.

Go-Devil's gentle and positive handling of loads up to 6000 lbs. means safer, more efficient transport of any type material in any part of the factory or yard. Give it 74" of aisle space and watch Go-Devil cut your materials handling costs.

The 360° rotating boom telescopes out and over... out to 16' to pick up castings, scrap barrels, cores or molds even in normally inaccessible areas. The 8000 lbs. capacity, 50 sq. foot deck area permits stacking and carrying of any material without using the hook. The compactness and close-quarter power steering of the Go-Devil get it in and out of tight spots with amazing ease.

Isn't all-around materials handling versatility, precision and safety important to your production picture? Then the answer is Drott Go-Devil. Fill out the coupon below now. *Ask about the 20 RM 2 Go-Devil, too!*

IT REACHES	IT LIFTS	IT SWINGS	IT TRAVELS	IT HAULS
24' up... 16' out	6000 lbs. with safety	360° continuous rotation	up to 19 MPH	on 50 sq. ft. of deck area



DROTT
MANUFACTURING CORP.
Milwaukee, Wisconsin

CLIP AND MAIL TO

DROTT MANUFACTURING CORP.
Materials Handling Division
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I'd like more information on the 60 RM 2 Go-Devil.
Please rush bulletin MH600.

Name.....

Title.....

Company Name.....

Company Address.....

City..... Zone..... State.....

For More Information Circle 652, Page 39

Foundry OVENS

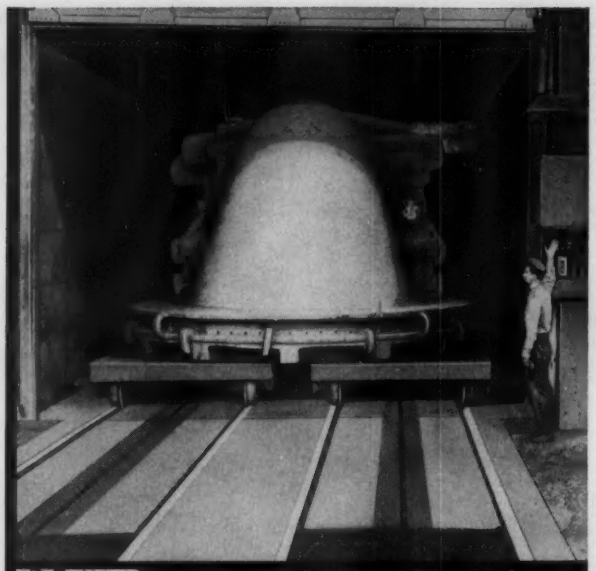
★ Car Type Mold Ovens

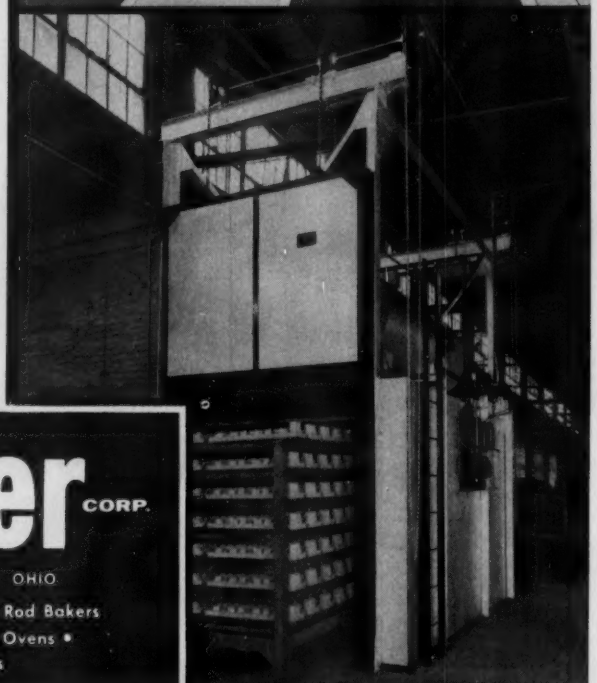
★ Rack Type Core Baking Ovens

★ Vertical Core Ovens

Carl Mayer designs and manufactures all types of ovens as well as "specials" to meet unusual operating conditions. Most incorporate the Carl Mayer recirculating heating system with sealed combustion chamber that keeps gases from prematurely escaping into the load area. Cores and molds are baked evenly with no burning. Temperatures are always under control.

Write for Bulletin 53-CM





TOP RIGHT—This large car type mold oven is installed at Pittsburgh Steel Foundry. Its special triple slotted panel construction reduces heat loss 1/3. Fuel savings up to 50% over old conventional methods are possible. Drying time is often cut in half and temperatures are uniformly controlled.

MIDDLE RIGHT—This rack type core baking oven is at the Fremont Foundry Co., Fremont, Ohio. It is equipped with a recirculating combination gas-oil fired heating system.

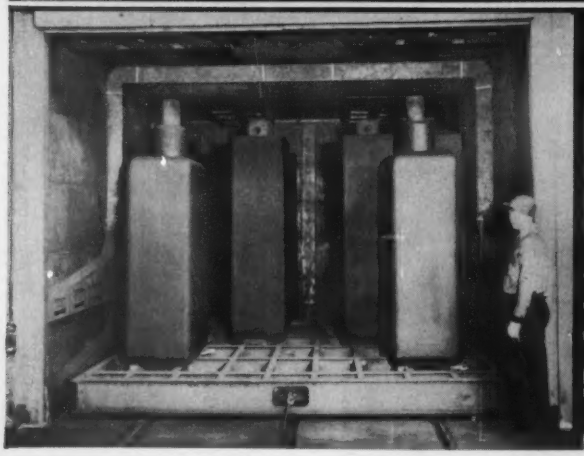
BOTTOM RIGHT—Vertical Core Oven (unloading position) at A. C. Williams Company, Ravenna, Ohio. This oven is 11'-0" wide x 11'-0" deep x 45'-0" high.

BELOW—Car type mold drying oven installed at Centre Foundry, Wheeling, West Virginia.

THE **carl mayer** CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories



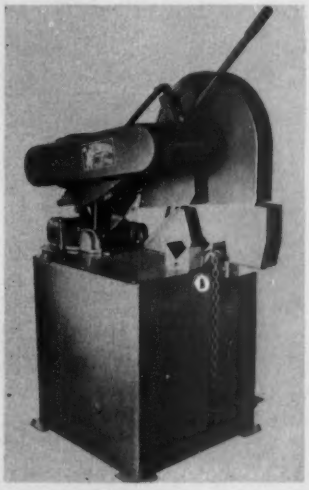
length by spaced baffle plates which direct the flow of air.

Separated moisture descends by gravity to the float trap, where it is ejected automatically and without loss of air. Flanged head and coil can be removed as a unit. Unit also is offered with optional automatic cooling water shutoff and in a horizontal design which fits into overhead lines.—**Jas. A. Murphy & Co.**, 1421 E. High St., Hamilton, Ohio.

For More Details Circle No. 478—Page 39

ABRASIVE CUTTING MACHINE

Abrasive cutting machine is said to cut up to 4-in. solids and most 6-in. shapes. A feature of the unit is the forward and backward movement of the wheel as it cuts, giving



extra cutting capacity, high quality cuts, and longer wheel life. A 20-hp motor provides power to cut at the rate of 3 to 4 sec per sq in. It is available with an air-operated power head, claimed to increase wheel life up to 30 per cent and provide complete uniformity of cut. —**Abrasive Machine Div., Beaver Pipe Tools Inc.**, Warren, Ohio.

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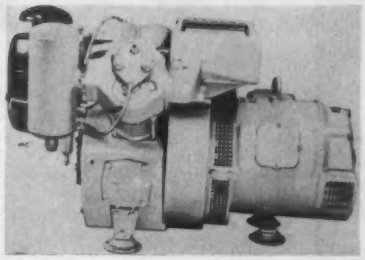
AIR COMPRESSOR

Air compressor Model TT6 is a two-stage, single-acting unit featuring total air cooling. It is rated for working pressures up to 125 psi. Output is 115 cfm at 100 psi when running at 1170 rpm and 141 cfm with 100 psi at 1450 rpm. Since unit is mounted on rubber, it can be used in permanent or temporary applications. Compressor weighs



between 1050 and 1350 lb and is 34 in. wide, 52½ in. deep, and 29½ in. tall.—**Atlas Copco Inc.**, 545 Fifth Ave., New York 17, N. Y.

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DUST FILTER

Reverse-air jet dust filter utilizing cloth felt uses wool, Dacron, and Orlon felts, depending on the application. A blow-ring assembly features adjusting springs to provide maximum filter tube cleaning with minimum wear. Through automatic pressure control, the high velocity airjet cleans excessive dust from the felt when necessary, without shutdown or bypassing.—**Koppers Co., Metal Products Div.**, 200 Scott St., Baltimore, Md.

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FIRST-AID KIT

First-aid kit designed for industrial use is offered in four sizes containing from 10 to 36 items. Containers are made of 20-gage steel and have reinforced electrically welded joints. A rubber gasket is fitted to each lid to keep out moisture. Wall brackets, carrying handles, and snap locks are built into the cases, Kits include compresses,

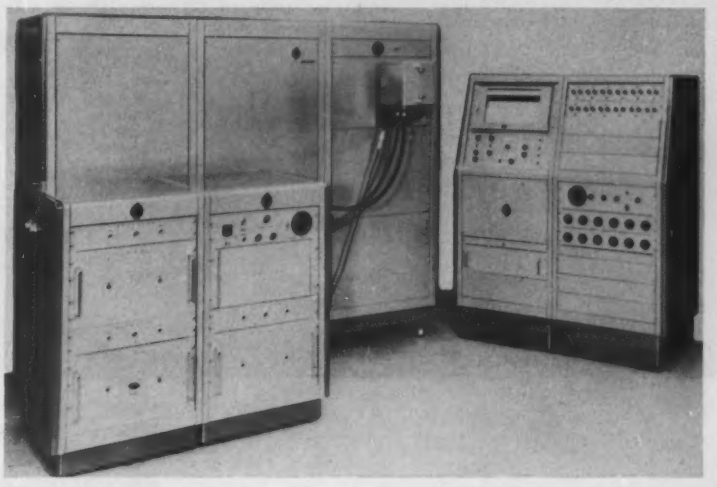
bandages, iodine swabs, tourniquets, inhalants, and burn salves.—**American Optical Co., Safety Products Div.**, Southbridge, Mass.

For More Details Circle No. 482—Page 39

X-RAY PAPER

Low-cost industrial x-ray paper produces 4 to 6 per cent sensitivity and is excellent for finding flaws

Direct Reading Unit Gives Rapid Analysis

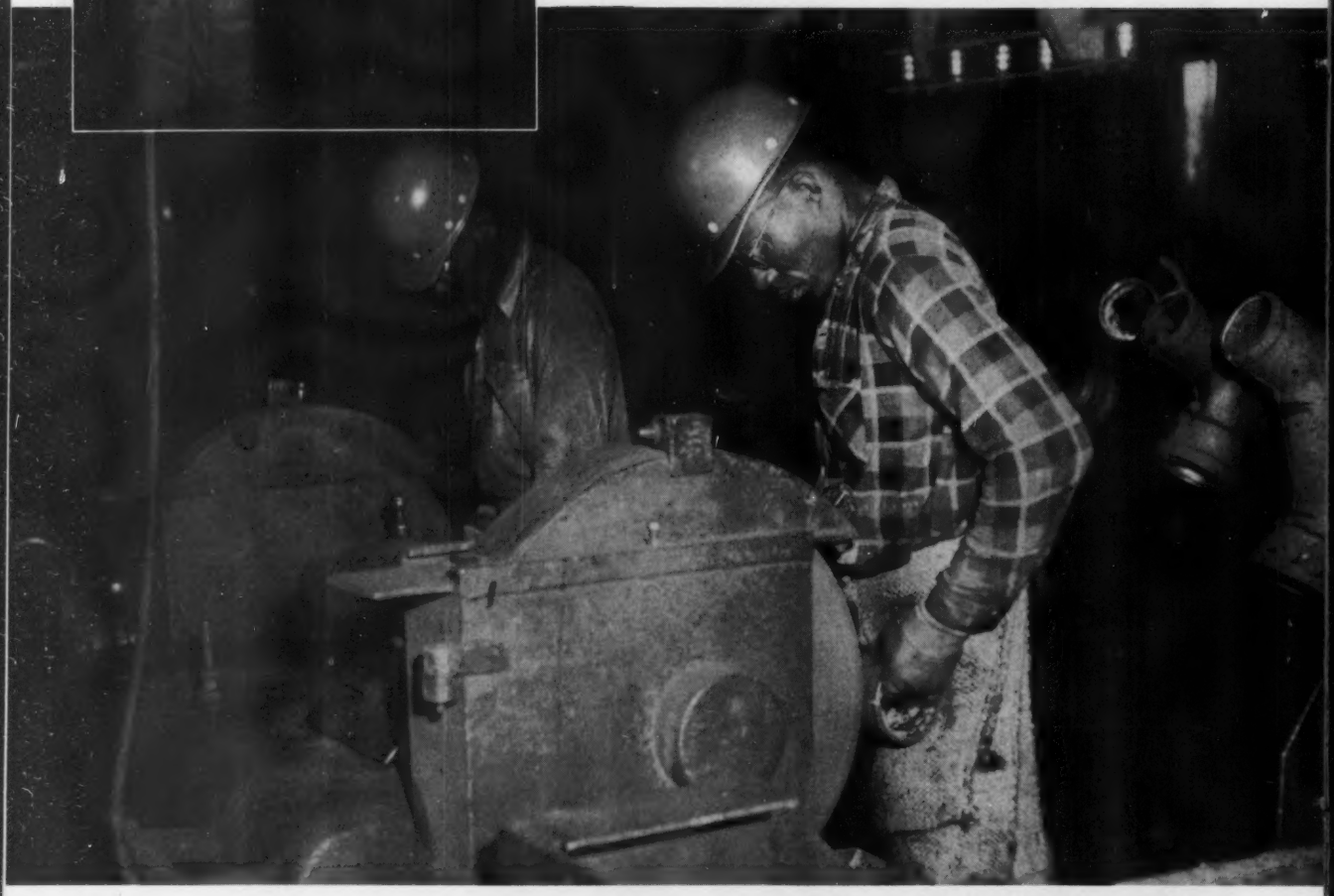


Direct reading spectrometer, Model 29000, plus a spark source and a recording console make up a spectrochemical analyzer known as the Quantometer. This unit is said to provide accurate, precise, and rapid chemical analyses of nearly every material used in industry. Company's standard electronic readout presents the concentration of each element on a permanent record every 2.4 sec after a 20-sec sparking of the sample. Up to 48 elements can be analyzed simultaneously. — **Applied Research Laboratories Inc.**, P. O. Box 1710, Glendale 5, Calif.

For More Details Circle No. 508—Page 39

How Frank Jones

John Warner (left), Foundry Superintendent, checks excellent finish on cast-iron elbow with Finishing Room Foreman Royce Barrett.



Operators Joe Pettigrew (left) and Wayne Walker (right) removing fins and parting lines from cast-iron fittings for soil pipe. They report the Bay State wheels they are using show less wear than any others they have used in spite of the fact that their cutting speed is much higher.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

helped Tyler Pipe lick a tough automation problem

These days, the very speed of automated production can turn out to be a headache instead of an advantage. In fact, a unique, automated pipe-casting process became just such a problem for Tyler Pipe & Foundry Co., of Tyler, Texas. Developed by Tyler's own engineering staff, the process enables the company to produce cast-iron pipe and fittings faster than any other known process or procedure.

The immediate result of this high-speed production was a serious bottleneck in the cleaning department where castings were finished. The snagging wheels in use simply couldn't keep up with the volume of work.

Rather than plunk a large investment into expanded facilities, Tyler's Purchasing Agent, R. S. Greenhaw, called in representatives of major abrasive manufacturers to see what they could do to break the bottleneck by boosting wheel performance alone. Among those called in was Bay State abrasive specialist Frank Jones who went over the whole snagging operation in detail. And the results paid off in substantially lower costs.

In plain figures, the Bay State wheel he recommended enabled the cleaning department to turn out over 20% more finished pipe and fittings per day than had ever been possible before.

All of which shows that Bay State's careful, analytical approach to grinding problems pays off in practical results. You'll find your own Bay State distributor and direct representative are equally well equipped by experience and thorough training to find practical solutions to your grinding problems. *Better grinding at lower cost... that is their business.*

Bay State abrasive specialist Frank P. Jones has not only had extensive experience in industry but has also had business college training. Consequently he knows which end of a balance sheet is up and says he figures that his business know-how makes his technical training doubly valuable. Proof of this claim lies in the first-class job he does for Bay State customers.

For More Information Circle 654, Page 39

in sharp-contrast items. A glossy print on a stiff paper base, it can be inspected directly without use of special viewing illuminators. — **Picker X-Ray Corp.**, White Plains, N. Y.

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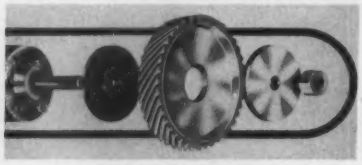
CONTACT WHEELS

Line of contact wheels for use with abrasive belts consists of a wide range of sizes, hardness ratings, and serrations. New self-aligning flanges



featured on the wheels are designed to be used on present equipment. Flanges consist of 1/8-in. steel discs faced with a rubber cushion which fits closely on the shaft, even when worn or scored. With this arrangement, centrifugal force is said to give perfect alignment and balanced, vibration-free operation. — **Cosmo-Wheels Inc.**, 1019 Fulton St., Chicago 7, Ill.

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PORTABLE SPOT HEATER

Portable spot heater is designed to be used in plants, foundries, warehouses, and other large areas too difficult and expensive to heat with conventional heating systems. Unit is 36 in. high, 17 in. in diam and weighs 24 lb. It is made of heavy gage steel and features an integral safety guard. Heater is rated at 80,000 Btu per hour and uses a stainless steel heater tube which is claimed to provide a catalytic action in contact with open flames of the burner to reduce danger of carbon monoxide. Natural, LP, or other types of gas can be used. It is available with manual variable turn-up and turn-down controls and automatic shutoff controls.—**Union Chill Mat Co.**, Saxonburg, Pa.

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INFRARED BURNER

Burner is designed for low-temperature industrial processing applications. Radiant heat emission is concentrated in the 2.0 to 4.0 micron band. Face temperature of the 4 x 18-in. burner screen can be regulated up to 1800° F. Nominal heat input is 30,000 Btu/hr. Units have built-in flame adjustment, and heat patterns can be profiled or contoured. Burners have cast iron integral manifolds and can be assembled into continuous lines up to 100 ft long.—**Bryant Industrial Products Corp.**, 17700 Miles Ave., Cleveland 28, Ohio.

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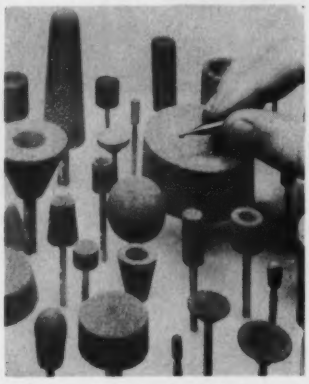
ABRASIVE WHEELS

Company has completed major upgrading of manufacturing standards for production of mounted abrasive wheels. Processing assures concentricity of spindle and abrasive section as well as tenacious bond of abrasive to spindle. Oversized molding is used to form wheels so that each can be finished to precise shape and size. This finishing operation provides an open structure so that each wheel is ready for immediate use. Also, greater tolerance in spindles is said to assure accuracy and



increased useful life.—**Bay State Abrasive Products Co.**, Dept. F, Westboro, Mass.

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AUTOMATIC DIECASTING UNIT

Automatic diecasting machine, Model MAC/99, is designed to produce small zinc diecastings weighing up to 1 lb at rates up to 1000 shots per hour. It is modular in design, resulting in flexibility and permitting various degrees of automation. Basic machine can be operated manually by pushbuttons. Plugging in the automatic cycle timer unit permits the machine to go through an automatic cycle with a push of a single button. Other features available include a brush device to clean the dies between shots, a device to control die temperature by regulating flow of cooling water, metal temperature control unit, and an automatic ladling preheat furnace.—**DCMT Sales Corp.**, division of British Industries Corp., Port Washington, N. Y.

For More Details Circle No. 488—Page 39

EPOXY REPAIR KIT

An epoxy-based material is included in kit for repairing castings, patterns, coreboxes, and molds. Material is 80 per cent aluminum and 20 per cent epoxy. It is prepared for use by mixing with an equal amount of hardening agent, also supplied with the kit. Three-oz tubes of both the epoxy material and the hardener are included in each kit. Adhesion to steel, iron, aluminum, bronze, glass, and other surfaces is claimed. —**Devcon Corp.**, Danvers, Mass.

For More Details Circle No. 489—Page 39

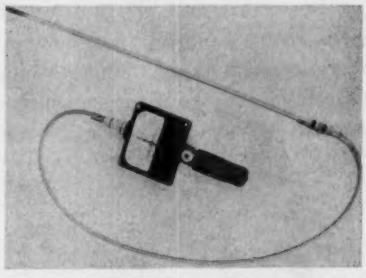
AIR VALVES

Air valves are lightweight and have quick response. Body and poppets are of anodized aluminum alloy, poppet seals are synthetic rubber, and poppet stems are zinc-plated steel. Series is called Headline and is available in straightway, 3-way, and 4-way types from 1/4 to 1 1/2-in. pipe sizes. All models conform to JIC standards and handle pressures of 30 to 150 psig in the head and 5 to 150 psig in the body.—**Ross Operating Valve Co.**, 120 E. Golden Gate Ave., Detroit 3, Mich.

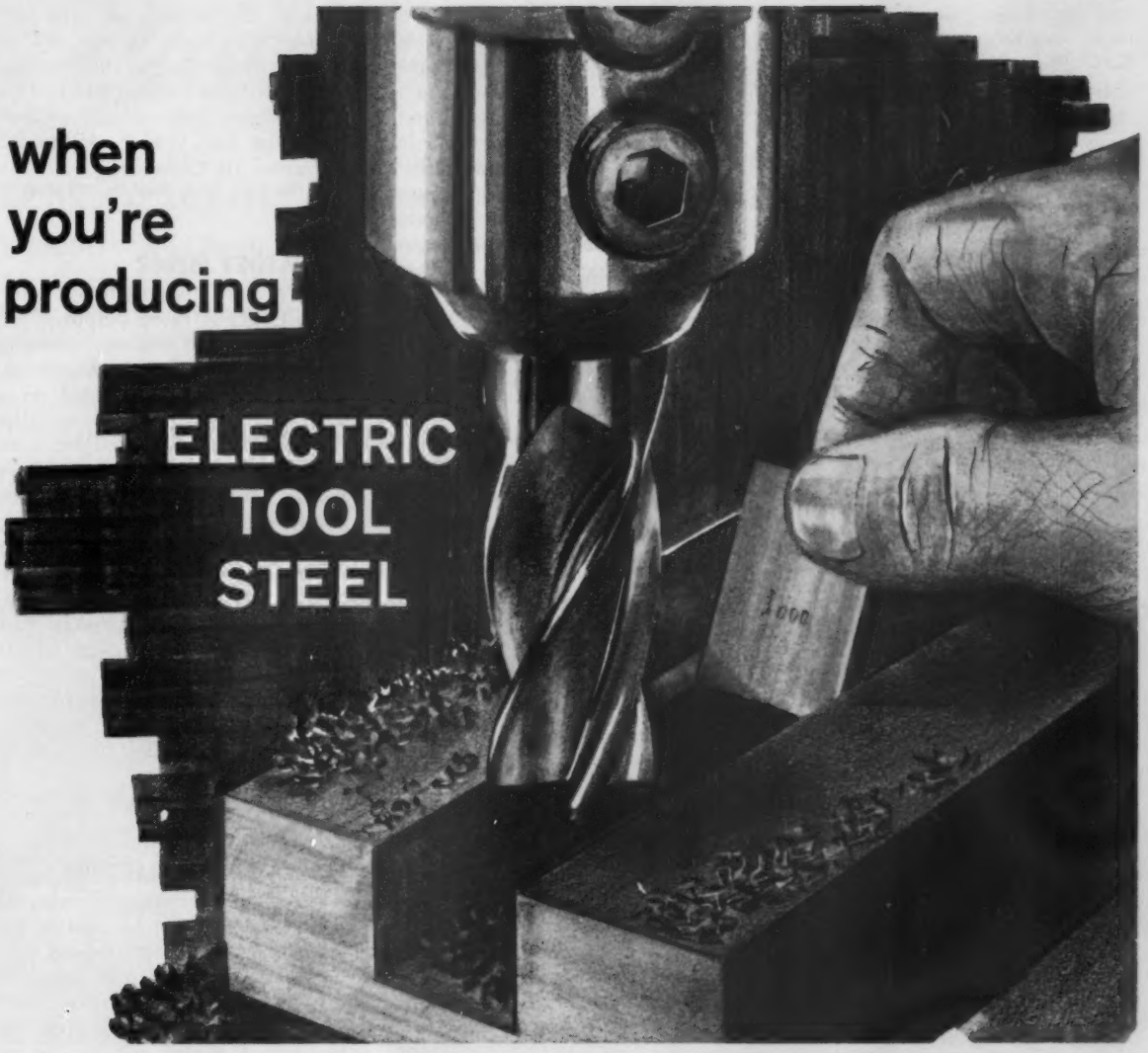
For More Details Circle No. 490—Page 39

HAND POTENTIOMETER

Hand potentiometer, designed for measuring temperatures of ovens, furnaces, and salt pots, is operated



by inserting the thermocouple, pressing a button, and reading the dial. Features include 0.5 per cent accuracy, automatic reference junction, shock-mounted jewels, and interchangeable thermocouples. Sev-



GLC Service Technicians can help solve your operating problems

Whenever you want **immediate assistance** in overcoming any graphite electrode problem, our entire technical staff is at your service. Our service organization makes it the rule rather than the exception to respond to a call **within 24 hours.**

GLC electrode technicians are thoroughly familiar with melt shop practice and problems. You can rely on their **promptness** and **competence** as fully as you can upon the **trustworthy performance** of GLC electrodes.

PRODUCTS YOU CAN TRUST — ELECTRODE — GLC — DIVISION

GREAT LAKES CARBON CORPORATION

18 EAST 48TH STREET, NEW YORK 17, N.Y. OFFICES IN PRINCIPAL CITIES

For More Information Circle 655, Page 39

eral ranges are offered with maximum temperatures as high as 3000° F. Similar models are available for measuring surface temperatures and molten metal temperatures.—**Pyrometer Service Co.**, 348 River Rd., North Arlington, N. J.

For More Details Circle No. 491—Page 39

PHOTOELECTRIC SAFETY DEVICES

Photoelectric protective equipment is designed to stop machine operation automatically when any part of a person's body such as a hand or arm enters the danger area. Units consist of a wide-beam, modulated light projector, a wide-beam photoelectric receiver, and a control unit. Standard units are 7, 12, and 17 in. wide. Light projector and receiver can be mounted any distance apart up to 15 ft. Controller operates when 2 in. or more of the light curtain is obstructed. To facilitate checking of the curtain on each stroke of a machine, a solenoid-operated shutter interrupts a small portion of the curtain on each upstroke. Should the curtain fail to respond to the shutter, the checking circuit produces a signal which stops the machine automatically.—**Clark Controller Co.**, 1146 E. 152nd St., Cleveland 10, Ohio.

For More Details Circle No. 492—Page 39

VIBRATORY FEEDER

Heavy-duty vibratory feeder, Model 75A, has a rated output of 75 tons per hour when operated level, and this figure can be increased when it is operated on a down slope. It is available as either a suspended or base-mounted unit. Electro-permanent magnetic drive system, which operates directly from alternating current, is completely enclosed. Five standard size trays in flat and tubular designs are available in all-welded mild or stainless steel construction. Special sizes can be furnished. Controls of the variable auto-transformer type vary the applied line voltage, permitting adjustment from zero to optimum feed rate.—**Eriez Mfg. Co.**, Erie 6, Pa.

For More Details Circle No. 493—Page 39

INSULATING REFRACTORY

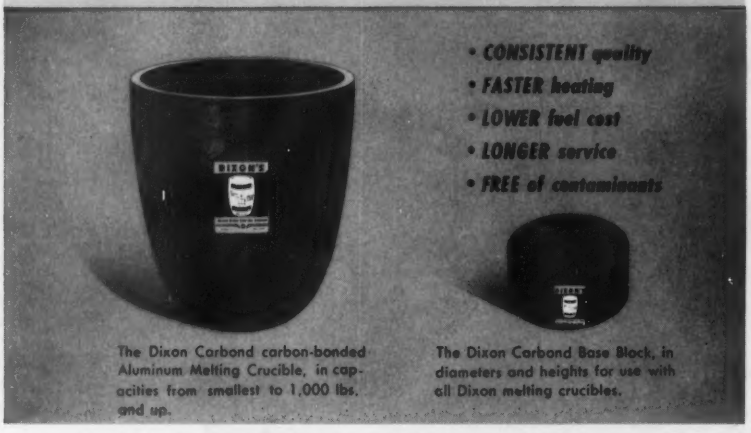
Insulating refractory comes in sheet form and can be used in the laboratory to wrap around hot containers for handling purposes or to insulate small ovens, beakers, and other equipment. As supplied, the material is pliable and can be cut with a knife or scissors. After it has been fitted in place around an object, material is allowed to air harden or it is baked at 350° F for faster results. Material comes in sheets 2½ x 1½ ft x ¼ in.—**Laboratory Equipment Corp.**, Hilltop Road, St. Joseph, Mich.

For More Details Circle No. 494—Page 39

WELDING HELMETS

Welding helmets and handshields are molded from glass fiber reinforced polyester. Helmets are available in three shell types which are straight, curved, and narrow front with either stationary or lift-front glassholders. Headgears are constructed of sturdy plastic and have a simple mechanism for instant, perfect fitting. Their suspension system is said to eliminate pressure points for maximum comfort. Hand-

More Heats Mean More Profits with DIXON'S Carbond ALUMINUM MELTING CRUCIBLES



The Dixon Carbond carbon-bonded Aluminum Melting Crucible, in capacities from smallest to 1,000 lbs. and up.

The Dixon Carbond Base Block, in diameters and heights for use with all Dixon melting crucibles.

Heat after heat, melt after melt, the keys to profitable production are dependability and economy, the kind of low-cost reliability that foundrymen have had from Joseph Dixon crucibles since 1827.

Dixon crucibles and other refractory products are made to give you *more*—more heats per shift, more melts per lifetime, more perfect castings and *more profit*—because the over-all cost is low.

Dixon knows the way to more profitable aluminum melting with better, money-saving refractories. For the complete story, send the coupon today.

Dixon manufactures a complete line of Crucibles, Base Blocks, Burner Tiles, Furnace Linings & Covers, Insulation, Ladle Liners, Bowls and Special Shapes.

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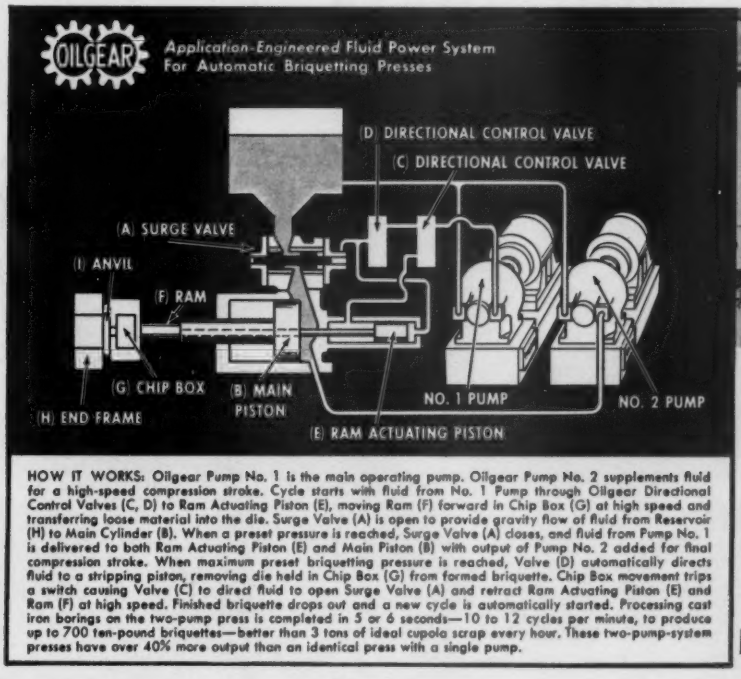
From Oilgear *Application-Engineering* Files

HOW OILGEAR-EQUIPPED BRIQUETTING PRESSES PRODUCE MORE—LONGER—AUTOMATICALLY

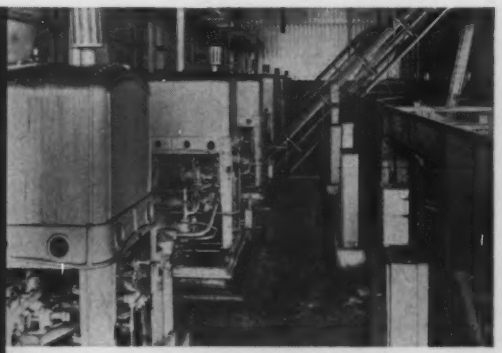
CUSTOMER: *Milwaukee Foundry Equipment Division of SPO Inc.*

DATA: To power a line of presses specially designed for low cost, rapid conversion of bulky, low-grade metal turnings and borings into dense, uniform-sized briquettes to: conserve storage space; simplify handling; prevent storage oxidation—particularly with finely divided metals or sponge iron; provide sufficient density and size to melt rather than flash into oxide on entry into foundry cupola; control metal content; provide a simple means of accurate compounding for alloying or supplying a flux.

PRESS SYSTEM REQUIREMENTS: 1. Eliminate wear and maintenance costs resulting from use of gears and bearings. 2. To be controlled hydraulically, electrically, or electrohydraulically for automatic cycling at rates ranging from 9 to 17 strokes per minute. 3. Sufficient force to provide briquette densities of 70 to 80% with conservative pump loading. 4. Long life, rugged dependability . . . capable of years of continuous operation with an absolute minimum of maintenance.



HOW IT WORKS: Oilgear Pump No. 1 is the main operating pump. Oilgear Pump No. 2 supplements fluid for a high-speed compression stroke. Cycle starts with fluid from No. 1 Pump through Oilgear Directional Control Valves (C, D) to Ram Actuating Piston (E), moving Ram (F) forward in Chip Box (G) at high speed and transferring loose material into the die. Surge Valve (A) is open to provide gravity flow of fluid from Reservoir (H) to Main Cylinder (B). When a preset pressure is reached, Surge Valve (A) closes, and fluid from Pump No. 1 is delivered to both Ram Actuating Piston (E) and Main Piston (B) with output of Pump No. 2 added for final compression stroke. When maximum preset briquetting pressure is reached, Valve (D) automatically directs fluid to a stripping piston, removing die held in Chip Box (G) from formed briquette. Chip Box movement trips a switch causing Valve (C) to direct fluid to open Surge Valve (A) and retract Ram Actuating Piston (E) and Ram (F) at high speed. Finished briquette drops out and a new cycle is automatically started. Processing cast iron borings on the two-pump press is completed in 5 or 6 seconds—10 to 12 cycles per minute, to produce up to 700 ten-pound briquettes—better than 3 tons of ideal cupola scrap every hour. These two-pump-system presses have over 40% more output than an identical press with a single pump.



Six Milwaukee Briquetting Presses that reclaim over 35,000 tons of cast iron scrap annually at an automotive manufacturer's integrated engine plants and foundry. Briquettes produced here are re-charged directly into cupolas.

One of the two Oilgear Type "C-60" Pumps indicated on a 350-ton **Milwaukee Briquetting Press.** Note how briquettes roll out of the press to be picked up by magnets.

SOLUTION: Oilgear *Application-Engineered* systems consisting of Oilgear Type "C" Heavy-Duty Constant Displacement Radial Rolling Piston Pumps and Directional Control Valves. Pump requirements range from 23 gpm on the 75-ton Presses to 325 gpm on new 1000-ton presses. *Milwaukee Foundry Equipment*—builder of over 80% of all briquetting presses, and an exclusive user of Oilgear Fluid Power Systems since 1927—recently reported: *"We just modernized a press that had been in continuous cast iron briquetting operation for over 18 years . . . there had been no reported major maintenance . . . the Oilgear components still operated fine—with no appreciable signs of wear or loss in efficiency."*

This is just one evidence—out of hundreds—of the long service life of Oilgear Systems. Ten or more years of continuous service is common with Oilgear equipment, rather than the exception . . . with many of these systems operating under adverse conditions—rapid cycling, grit-laden air, heat, and extreme humidity. Where the going is toughest—Oilgear Pumps just keep rolling along . . . quietly, efficiently.

With Oilgear Heavy-Duty System Components designed for thousands of hours of continuous service at full rated load, savings are compounded with every hour of uninterrupted performance. That's why machinery and equipment manufacturers and *their* customers say . . .

"for the lowest cost per year . . . it's Oilgear!"

For solutions to YOUR linear or rotary Controlled Motion problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

THE OILGEAR COMPANY

Application-Engineered Controlled Motion Systems

1573 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN

Phone: Mitchell 5-6715 . . . Direct Distance Dialing Code 414

shields are available in straight or curved shell models. Plain or hardened filter plates in 12 shades, clear glass and plastic cover plates and a standard line of replacement parts and accessories are available also.—**Linde Co.**, division of Union Carbide Corp., 270 Park Ave., New York 17, N. Y.

For More Details Circle No. 495—Page 39

RADIATION THERMOMETER

Radiation thermometer, Model TD-16, automatically measures and controls temperature without contact. Unit provides accurate temperature measurement from 210 to 3300° F and is compensated for ambient temperatures from 50 to 120° F (up to 175° F with optional water cooling). Optical head, which measures 3 x 4 x 7 in. and weighs 3 lb, has a focusing range between 20 in. and infinity. Control unit measures 12 x 14 x 5½ in. and weighs 25 lb.—**Radiation Electronics Co.**, division of Comptometer Corp., 5600 Jarvis Ave., Chicago 48, Ill.

For More Details Circle No. 496—Page 39

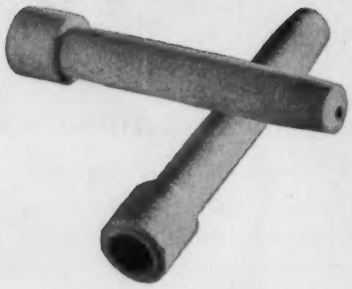
BIN VIBRATOR

Bin vibrator is designed to move materials which bridge over supply bins. Designated Bridge Breaker, unit employs vibrating expanded metal screens mounted inside the bin parallel to the walls. Vibrators mounted outside the bin transmit vibrating action to the screens by shock-mounted studs that pass through the walls. Screens are available for areas up to 4 sq ft, depending on material and bin configuration, and are adaptable to flat or conical surfaces. Stainless steel construction is offered for special applications.—**Thayer Scale Corp.**, Thayer Park, Pembroke, Mass.

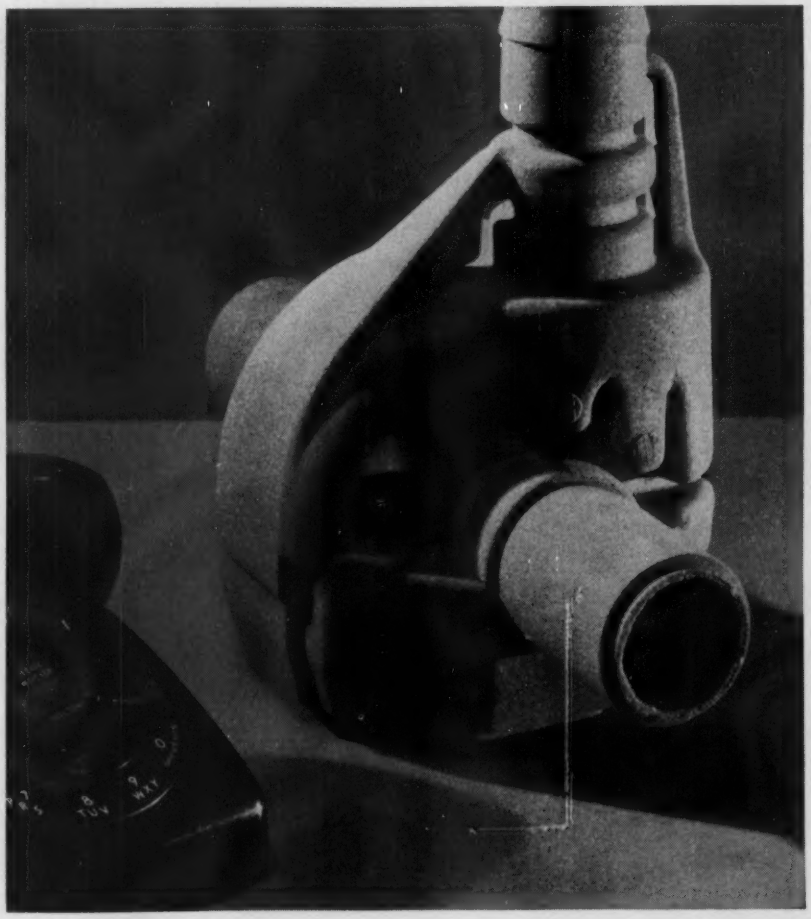
For More Details Circle No. 497—Page 39

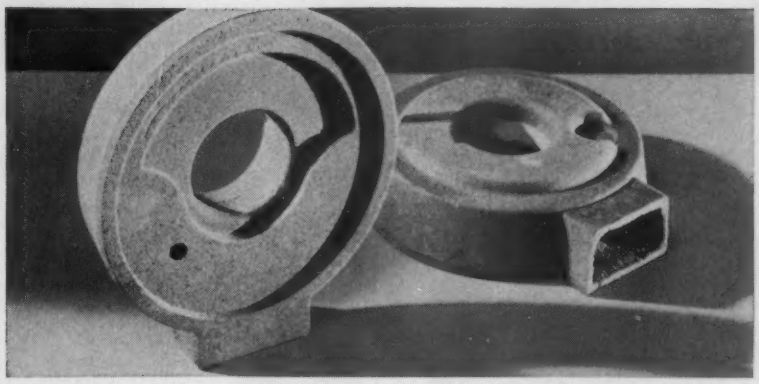
PRESSURE SWITCH

Electric pressure switch for water systems and air compressors is available in two enclosure styles. Features include pressure wire connectors, visible fine silver contacts, no-drift pressure settings, and snap action. Units are available with contacts which close at low pressure setting, close at high pressure setting, or with one normally open and one normally closed contact. All parts are either corrosion resistant or have been treated to resist



Shell cores start a chain reaction and lop 50% off core costs





Read how cores like these bonded with Durez resin are setting new records for economy at Auto Specialties Co. (Canada) Limited.

They weigh much less, so they're easier to handle. They use less sand.

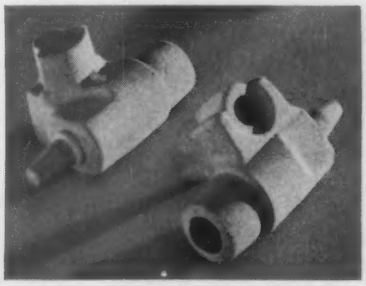
But that's only the start of snowballing savings this foundry makes with shell cores—cores bonded with Durez foundry resins.

On one casting, for instance—an automotive differential housing—dimensions are so accurate now with shell cores that gauging has been eliminated. A tube core fits the body core so snugly that flash no longer forms on the inside of the casting. As a result, foundrymen have been able to forget about a previously needed air-hammer chipping operation.

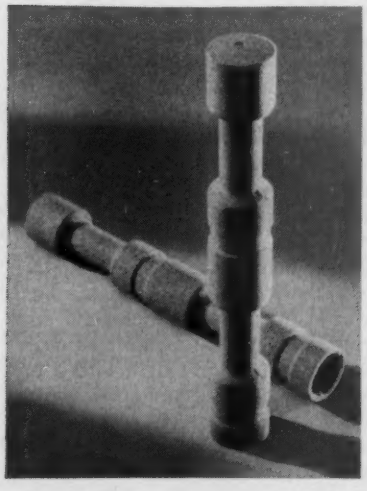
Altogether, savings come to just about *half* the previous core cost. And the foundry is chalking up similar records on many other jobs.

Fewer cores needed. Multiple stick cores now replace single cores to save setting time. One casting, formerly made with four oil-sand cores, requires only two shell cores.

What's more, the shell cores don't have to be dried. When finished, they're sturdy enough to stack without breaking. Because less storage space is needed, it's much simpler now to maintain a backlog of cores for filling rush orders.



Is it any wonder that, after producing 70,000-plus shell cores, men of this foundry are sold on the process more solidly than ever?



What you can do about this. One good way to explore shell-core economies for your foundry is to call in your Durez technical service man. He has helped many foundries convert to this process, so can give you answers based on practical experience. He can show you how to minimize shell-core and shell-molding problems with the consistent day-to-day and month-to-month results Durez foundry resins give you. Have a talk with him soon.

Here's the latest on shell molding—authoritative, up-to-the-minute data on patterns, materials, mixing, temperatures, lubricants, molds, cores. It's the 36-page *"Durez Guide to Shell Molding"* that can help you evaluate the process for your foundry. Write for your free copy today.

DUREZ PLASTICS DIVISION
HOOKER CHEMICAL CORPORATION
1005 WALCK ROAD, NORTH TONAWANDA, NEW YORK

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PLASTICS

For More Information Circle 657, Page 39

corrosion. When used on air compressors, a mechanically operated unloader valve is available to remove high-pressure air between cylinder head and check valve. — **Furnas Electric Co.**, 1151 McKee St., Batavia, Ill.

For More Details Circle No. 498—Page 39

HEAVY-DUTY VIBRATOR

Vibrator will develop 12 tons of unbalanced force at 3000 rpm for service on large chutes and bins. Unit weighs 231 lb and can be equipped with pneumatic or hydraulic drives. Frequency can be controlled from 0 to 3000 rpm by regulating flow of air or oil. Adjustments to the unbalanced force are made by adding or removing lead shot to the eccentric weight. Vibrator is claimed to give low noise level and operate in any position.—**Martin Engineering Co.**, Neponset, Ill.

For More Details Circle No. 499—Page 39

VARIABLE-SPEED TRANSMISSION

Variable speed hydraulic transmission provides speeds from 0 to 1600 rpm for continuous high-torque, heavy duty applications. Drive can be provided at 1800 rpm or less by any 2 to 10-hp motor or 20-hp gas engine. Speed is selected by a handwheel, but this arrangement can be altered for remote control. A neutral off position is provided. Unit weighs 100 lb and is 22 in. long (excluding shafts), 13 in. wide, and 16 in. high. Input shaft is 4 x 1⅜ in., and output shaft is 4 x 1⅝ in.—**Roberts Electric Co.**, 849 W. Grand Ave., Chicago 22, Ill.

For More Details Circle No. 500—Page 39

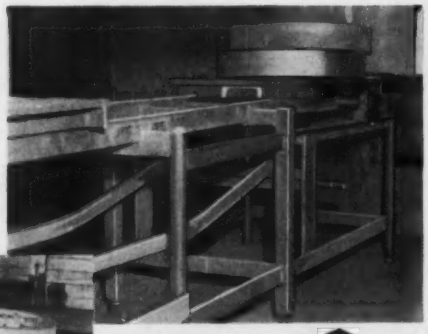
LABORATORY FURNACE

Automatic furnace, Model No. UL3LF, requires only 690 watts to operate at melting temperatures from 500 to 2000° F. Stainless steel housing is fully lined with high-temperature insulation and includes a preheat chamber. Work chamber is 1¾ in. wide, 1¼ in. high, and 2¼ in. deep and includes a porcelain charging tray. High-temperature coiled alloy wire heating elements, supported by a cast refractory muffle shell, provide even heat distribution throughout the chamber. Unit operates on 115 v ac and features a pyrometer scale reading in both Centigrade

NOMAD CONVEYORS Service 36 Operators *quickly*
— insuring even flow of work
at Ingersoll-Rand Foundry, Painted Post, N. Y.

Four 81-ft. Nomad 2-Level Track Conveyors handle castings in this cleaning room through chipping and grinding to inspection. Only a few service personnel are needed to keep work flowing to the 36 work stations. Castings, on wheeled pallets, ride to open work stations.

TRANSFER CARS TRAVEL BACK AND FORTH AT RIGHT ANGLES TO CONVEYOR — Transfer cars at each work station bring castings to each operator. Another pair of rails on the transfer car automatically comes into position and keeps the main track open for "through" traffic at all times. When chipping and grinding are completed, the operator pushes the transfer car back to the conveyor line. Castings then move on to inspection, leaving the work station ready for the next castings.



Castings coming into a work station.

This tilting device on each conveyor slides empty pallets onto the lower track. Pallets return by gravity to the starting end of the conveyor.

Write Today ***to learn how you can get service and flow in your foundry.***

NOMAD EQUIPMENT CORPORATION
3110 W. FOND DU LAC AVE. • MILWAUKEE 10, WIS.
DESIGNERS and MANUFACTURERS of COMPLETE CONVEYOR SYSTEMS

NOMAD EQUIPMENT

and Fahrenheit. Over-all, it is 8 in. wide, 11 in. high, and 13 in. deep.—**K. H. Huppert Co.**, 6830-40 Cottage Grove Ave., Chicago 37, Ill.

For More Details Circle No. 501—Page 39

ABRASIVE DISC WHEELS

Line of abrasive disc wheels, known as the Alpha line, is used for notching and general trimming. Wheels are rigid type made from abrasive bonded with resinoid and feature triple reinforcement for greater safety, strength, and durability. They are available in 7 and 9-in. diameters with a choice of 1/8, 3/16, 1/4, and 3/8-in. thickness. Center hole is depressed 7/8 in., and grain size from 114 to 120 is offered.—**Atlantic Abrasive Corp.**, South Braintree 85, Mass.

For More Details Circle No. 502—Page 39

VACUUM PUMPING SYSTEM

Ultrahigh-vacuum bell jar pumping system, Series 1450, is said to be suitable for long term testing in the 10^{-8} mm Hg range. The valveless system is equipped with double-pumped O-rings and incorporates a high-speed, 6-in. diffusion pump and a large, polished, stainless steel liquid nitrogen baffle. The baffle is constructed integrally with the bottom part of the chamber wall forming an effective antimigration barrier. Unit has an unobstructed work space 22 in. in diameter by 24 in. high and is complete with vacuum instrumentation. — **General Vacuum Corp.**, 81 Hicks Ave., Medford 55, Mass.

For More Details Circle No. 503—Page 39

EPOXY PARTING AGENT

Parting agent is for use in manufacture of epoxy and polyester castings. It is claimed to produce films with the advantages of fast drying, good adhesion to irregular and sharp contours, and surface tension that covers minor mold defects. Material can be thinned with tap water for spraying. Film can be removed by stripping or warm water wash. Two types are available. One is a bright fluorescent color to facilitate control of parting film thickness; the other is colorless to eliminate need for film removal. — **Schwartz Chemical Co.**, 50-01 Second St., Long Island City 1, N. Y.

For More Details Circle No. 504—Page 39

"Electric arc melting gives us improved metallurgical quality at an economic advantage," says Birdsboro Corporation.

Steel castings provide a wide range of selective materials, both as to chemical analysis and mechanical properties, which are suitable for application in various service and environmental conditions. The recent selection by Birdsboro Corporation of two new electric arc furnaces to replace open hearths and to complement existing arc melting facilities has contributed markedly to diversification of their steel foundry operations to meet these requirements.

Demand has been matched with flexible melting capacity through installation of two Heroult Electric Arc Melting Furnaces:

Shell Size	Capacity	Melting Rate
8-foot	10-ton	2 tons per hour
13.5-foot	30-ton	7 tons per hour

These two furnaces increase total electric melting capacity to 300 tons per day.

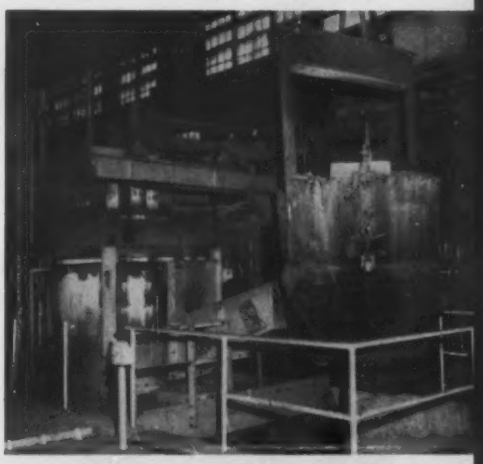
Service to customers was the primary requisite in Birdsboro's selection of this equipment. In addition, sales possibilities have increased, quality of metal is superior, alloy recovery is higher, maintenance is reduced, and man-hours per ton is lower. Result—steady improvement of steel melting costs.

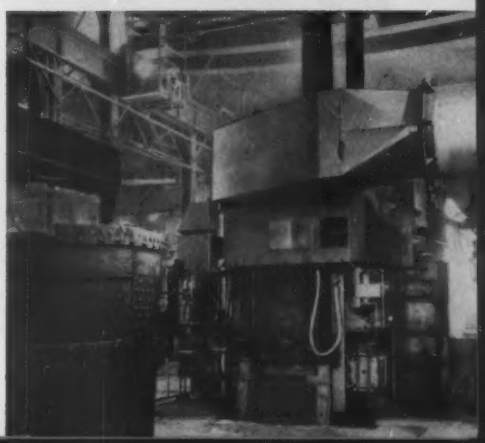
American Bridge constructs furnaces for all types of arc melting, in charge capacities to over 200 tons. You can select door-charge or swing roof top-charge types. Your crew can easily maintain a Heroult furnace.

If you're after melting flexibility, increased production, and lower costs, check American Bridge's complete design, construction and installation service.

USS is a registered trademark

This mark tells you a product is made of modern, dependable Steel.





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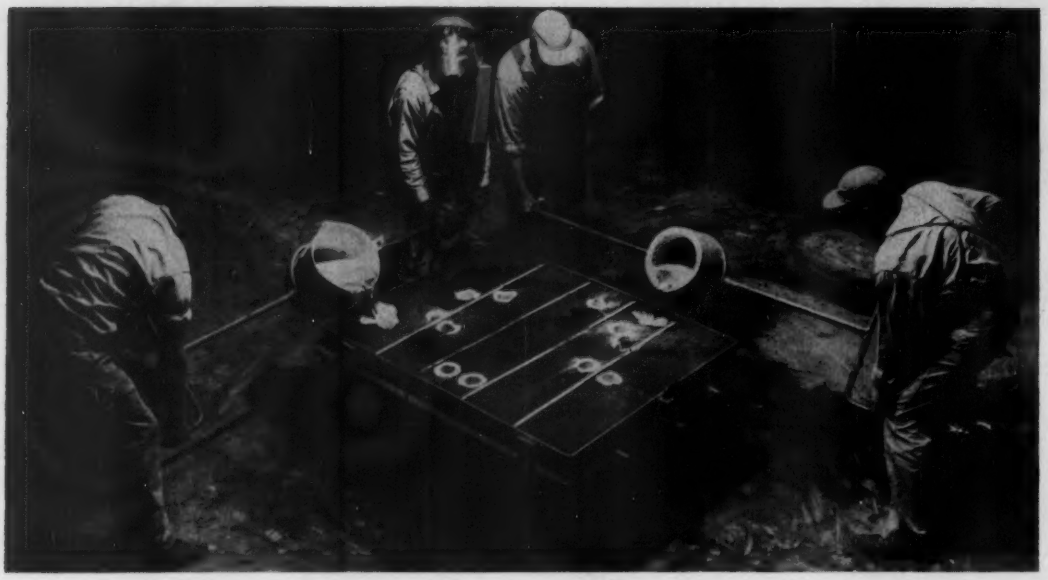
American Bridge Division of United States Steel

USS

For More Information Circle 659, Page 39



Foundry employees pour turbine compressor mold. Large molds, made in flasks up to 4 x 8 ft, are made on the floor. Pouring operation is a community project

QUALITY COMES FIRST

At Boeing Airplane Co. Foundry

Aluminum sand castings made at Boeing's Industrial Products Div. foundry are cast 100 per cent to military or government specifications. Unusual feature is the use of all-olivine molding sand

By JACK C. MISKE
Associate Editor

● CASTING QUALITY comes first at Boeing Airplane Co.'s Industrial Products Div. foundry in Seattle, Wash., which produces aluminum sand castings for gas turbine engine, missile, and aircraft applications.

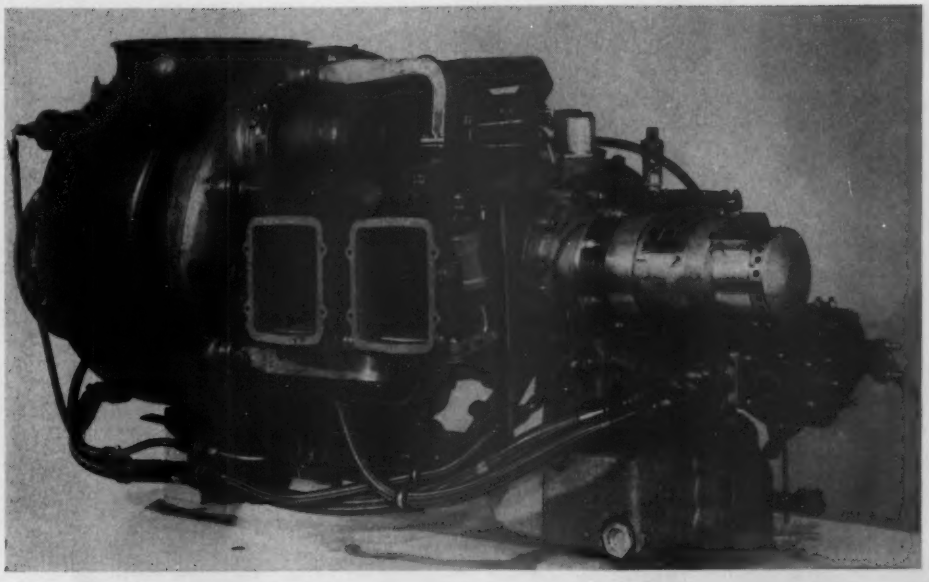
Unusual features of operation include 100 per cent casting to tough military and government specifications, large production in high-strength alloys such as A356, and the use of 100 per cent olivine molding sand and 100 per cent CO_2-hardened, sodium silicate-bonded cores.

A number of factors hold production volume to 12,000 to 17,000 lb of trimmed castings per month. These circumstances include short runs; variations in casting type, size, complexity, dimensional accuracy, and surface finish; and the fact that the foundry does considerable research and development work.

Of prime importance, however, is the constant drive for quality, which overshadows other considerations. This attention to quality plus the rigid casting specifications lead to some extra inspection methods, including the destructive testing of sample castings. Nevertheless, per-piece casting price is not out of line.

Types of Castings—Missile work includes structural castings for the Bomarc missile, ground handling equipment for Bomarc missile assembly, and ground support equipment for Minuteman, the newest intercontinental ballistic missile. Aircraft structural castings are made for the 707 jetliner, the B-52, and for the KC-135 tanker and other planes based on the 707. Among these castings are electronic cases, dolly frames, gearboxes, pulley brackets, pulleys, fuel system parts, levers and handles, fasteners, and others.

Currently, however, the largest volume of work involves production of castings for the Boeing gas turbine engine. These shaft turbines are used in a wide variety of appli-

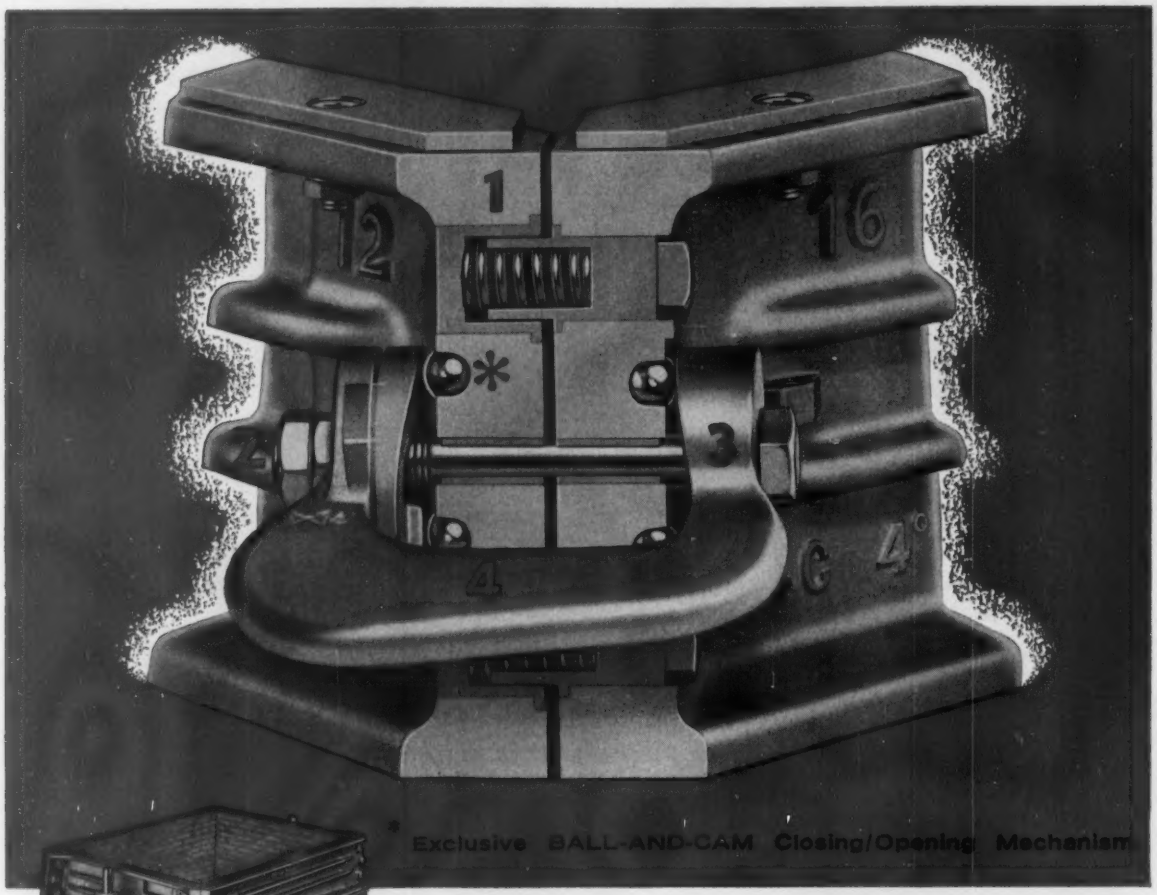


T60-BO-2 gas turbine is designed for applications in military and commercial light aircraft and helicopters. It uses several dozen high-quality castings

Molding machines currently include the two pin lift machines in the background. When finished, molds are placed on roller conveyors in foreground and are poured there

Furnaces include, from left to right, rear, a 400-lb crucible furnace, an electric induction furnace to preheat ingots to 800-900°F, and a 50-kw electric induction melting furnace. A 100-kw induction melting furnace also is used, but is not shown

New Snap-Flask Locking Device...



THE STERLING SlipSter

The New Sterling SlipSter offers precisely the advantages you want for your flask operations . . . ease of use, speed with quality production, minimum servicing. Whatever your requirements . . . single or double pin closing, hardened steel bushings, handles, trunnions and upsets . . . the SlipSter fills every need more efficiently.

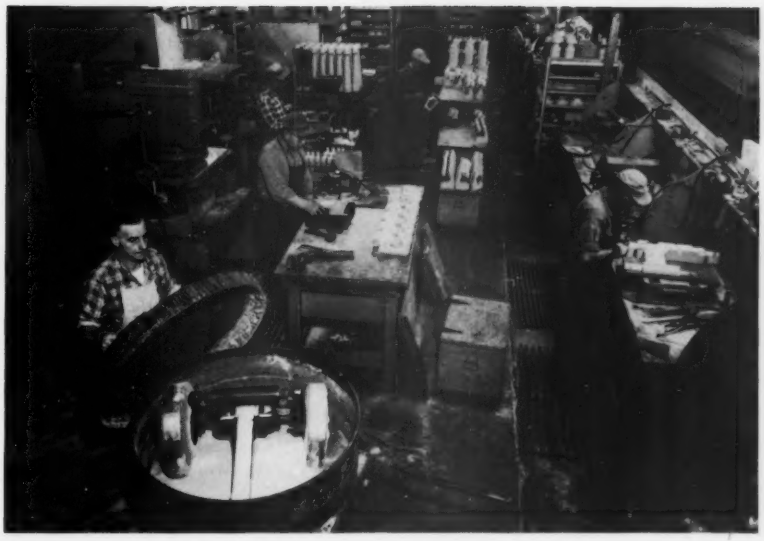
Your Sterling representative will be glad to show how you and your foundry will benefit.

1. Shielded-spring sleeve design eliminates frequent lubrication and servicing.
2. Floating Cam provides easy 1-Point Servicing.
3. Easy operating Split Cam produces maximum opening.
4. Broad-faced handles assure instant, positive opening/closing.

Sterling WORLD WIDE SERVICE

STERLING NATIONAL INDUSTRIES, INC.

MILWAUKEE, WISCONSIN • ASSOCIATE: STERLING FOUNDRY SPECIALTIES LTD., LONDON • BEDFORD • JARROW-ON-TYNE, ENGLAND



Coreroom facilities include muller in foreground, coreshooter at left, and coreblower behind it. Intricate cores and short runs require much bench work

cations including light aircraft, helicopters, landing craft, personnel boats, pleasure craft, fire trucks and earthmoving tractors. They also drive pumps, shipboard electrical generators and compressors for jetliner ground support. Up to 32 castings are used for aircraft engines and more than 40 in turbine-driven air compressors.

Such castings include accessory drive housings, gear reduction housings, compressor cases, burner adapters, diffusers, bearing retainers, oil sumps, fittings, air inlet bells and housings, shrouds and many more.

Casting weight varies from 2 oz to 250 lb, in sizes up to 60 in. long by 36 in. wide and 10 in. deep. Complexity varies from simple geometric forms to highly complex core assemblies. Dimensional accuracy is held between plus or minus 0.015 in. to ± 0.030 in., depending on design and size. In thin-walled castings such as the air inlet housing for the company's 520 gas turbine, wall sections are held to 0.150 in. with a tolerance of ± 0.020 in.

Patterns—All patterns are produced in the foundry's pattern shop, which employs six men. Patterns for short-run work are made of Honduras mahogany unless thin-walled, very close-tolerance work is involved. For the latter and for runs of 100 parts or more, metal patterns of 356 aluminum alloy are cast in the foundry. If a pattern is so complex that it would require much finishing after casting, or if a short-run job becomes a long-run job, plastic steel or aluminum may be used. In this technique, a male plastic metal pattern is cast from a plaster female. All patterns are mounted and gated permanently. Coreboxes follow the same general system as the patterns.

The foundry regularly produces castings such as 707 door handles with such a smooth finish that only light buffing is required before assembly into the aircraft. The patternmakers also make a wide variety of master engineering models and detailed quarter-scale turbine engine models for use in sales promotion.

Melting—At present, metal is melted in two low-frequency induction furnaces, of 250 and 500-lb capacity, and in a gas-fired crucible furnace of 400-lb capacity. As metal demand increases, however, it is anticipated that two 1000-lb capacity gas-fired crucible units will replace the low-frequency furnaces.

Alloys melted include A356, 356, C355, 142, and A140. Ingot is stored indoors and is preheated in an electric furnace before melting. All alloys but 356, which is cast most often, are melted in the crucible furnace. Due to specification requirements, no remelt is used.

A spectroanalysis is performed on each heat of alloy purchased. Spectroanalyses also are performed twice daily on each furnace in operation —once early in the morning and again early in the afternoon. At least one sample is pulled on each heat of a new alloy.

To check for gas content, a vacuum test is made in the foundry on every heat before the furnace is tapped. Each furnace is equipped with automatic nitrogen degassing equipment in the form of carbon lances at the bottom of the unit. Nitrogen for this operation is drawn from cylinders.

Melt temperatures automatically are held to within ±10 degrees Fahrenheit. Pouring temperature ranges from 1275 to 1400° F, depending on the alloy and the application, and titanium grain refiner is used.

Olivine Molding Sand—One of the most interesting features of the Boeing foundry's operation is the use of 100 per cent olivine molding sand. With the exception of small amounts of 200 AFS fineness olivine sand employed as facing in special applications, the system employs nothing but 130 AFS fineness olivine. It contains about 12 tons and is kept at that level by withdrawals to compensate for facing additions.

Sand is received in 100-lb sacks and stored indoors. It is mixed in batches which contain 500 lb sand, 6 per cent southern bentonite, 6 per cent western bentonite, and 3½ per cent water. Occasionally, about 1 per cent wood flour is added to special batches for molding of castings which are large and flat or smoothly contoured. New sand is mulled for 5 minutes, reconditioned sand for 3 minutes.

When sand is reconditioned, additions of water are made on the basis of a moisture detector reading. Southern bentonite is added as the need is indicated by sand laboratory tests, which are made twice a day. No western bentonite is added since the only metal cast is aluminum, which does not burn it out.

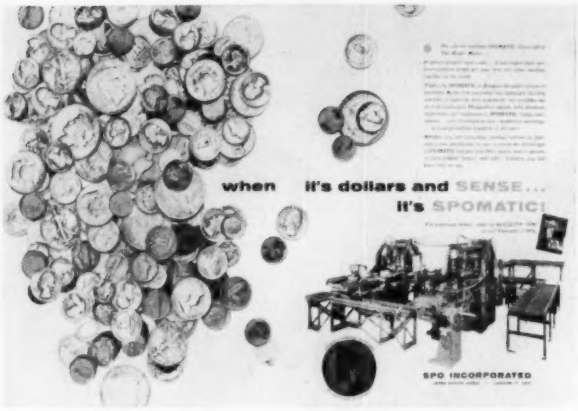
Permeability ranges from 60 to 85. When the system is new, permeability is about 60, and it rises with core sand additions, which gradually contaminate the system so that it is changed completely approximately every 9 months. The core sand is a 100 AFS fineness washed silica which so far as possible is kept out of the system during shakeout and is knocked out separately.

Moisture varies from 2.8 to 3.5 per cent, depending on sand temperature, atmospheric temperature, and

Next Page Circle 661 on Page 39→

1952

1953



THERE'S
A
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EVERY
MOLDING
JOB

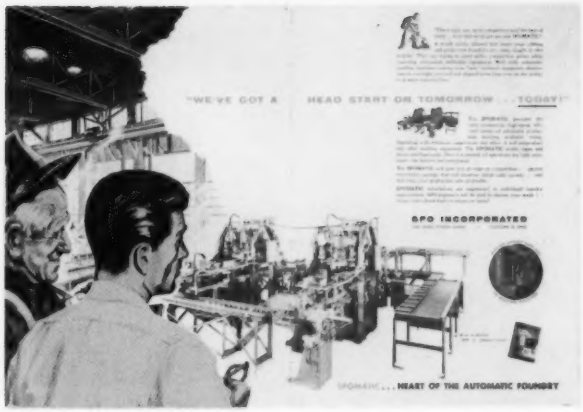
WORLD'S LARGEST SUPPLIERS
SPO
OF MOLDING MACHINES

1957

1958

- In an industry as specialized as the foundry, leadership cannot be assumed . . . it must be earned through capability and accomplishment.

1954



1955

It was in 1952 that a SPO advertisement (upper left) stated that "sweet music" in the foundry is the sound of profitable production. This was also the year that SPO was acclaimed World's Largest Supplier of Molding Machines. We have maintained our position of leadership through creative engineering as well as advanced equipment designs. But there have been significant changes within the foundry industry . . .

. . . you, the foundryman, have faced problems of competition, rising costs, materials changes and machinery obsolescence.

. . . SPO, a basic supplier, has made every effort to help you to meet these challenges, and we have also devoted efforts to develop new equipment so that you will be able to handle future production price requirements.

All of us (men of the foundry and those people you refer to as suppliers) have undetermined problems on the new horizons of molding progress.

1960

1961

SPO INCORPORATED

6449 GRAND DIVISION AVE. • CLEVELAND 25, OHIO

the job being run. All of these factors are correlated so far as possible. Sand temperature ordinarily averages from 80 to 85° F. The system is used once or a little more than once per shift.

Green compression strength ranges from 6 to 9, and clay content is kept at 10 to 12 per cent by the southern bentonite additions.

Core Sand—As mentioned before, core sand is a 100 AFS fineness washed silica. All cores are made by the CO_2 hardening process with mixes containing nothing other than 3 to 4 per cent of a proprietary sodium silicate binder. The variations in binder content are made to increase or decrease collapsibility, as a given job requires. In addition, three grades of binder with varying collapsibility characteristics are used.

Cores are shot, blown, or made by hand on the bench. Benchwork is required because of the extensive use of chills in some cores or because of core complexity. Experimental work also is done by hand.

Wood, metal, and plastic coreboxes are used, but the majority are wood because of the large amount of short-run production handled in the foundry. Some cores require a good deal of core assembly, and joints are sealed with an alcohol-graphite compound.

Cores vary from 1 oz to about 50 lb and from pin cores $\frac{1}{4}$ in. in diam to some 38 in. long by 6 in. square.

A 6-ton liquid converter provides CO_2 for the gassing system, which is manifolded to each station. Gassing time is controlled automatically.

Molding—Sand is moved from the vibrating shakeout, which is used carefully to avoid flask and casting damage, to a sand storage bin. It then is transported by auger to a skip hopper, which is elevated and the sand dumped into the muller. After mixing, sand goes through an aerator to an elevator and is raised to the distribution belt.

Molding equipment, which probably will undergo some revision shortly, consists of three units—two jolt-squeeze pin-lift machines and one jolt-squeeze. Sand on the distribution belt is carried to a double-hopper arrangement for the pin-lifts. It falls off the belt and is diverted by a flow divider. The jolt-squeeze gets its sand in skids, as do floor molders.

Maximum flask sizes on the molding machines are 24 x 30 in. for the pin-lifts and 16 x 20 in. for the jolt-squeeze. Floor-molded flasks run up to 4 x 8 ft. Work done by floor molding includes large work, tooling tryout castings, research and development work, and some small production runs.

Molders make molds, set cores, close molds, and, with the help of anyone else handy, pour their own molds. A hoist is situated over each pin-lift unit, and a bridge crane handles the floor molds. Jolt-squeeze molds are placed on a roller conveyor.

Contoured aluminum chills also are employed extensively in molds to achieve directional solidification and improved mechanical properties. Their presence often eliminates the possibility of jolting molds, since chills would shift, and pneumatic ramming then is substituted.

Strainers are used in either the pouring basins or runner systems, and all gating is calculated carefully. Two sprue-runner-endgate ratios are used—1-4-4 and 1-4-6.

Cleaning — Equipment in the cleaning room includes two bandsaws, two belt grinders, and benchwork tools. Casting straightness is checked on a surface plate with height gages or checking fixtures.

Inspection—The degree of inspection is controlled by military and Boeing specifications. All castings, except tooling castings, are made to one of these four specifications: MIL - A - 2118OB, MIL - C - 6021D, QQ-A-6016 or BAC 5949. The degree of inspection varies from 100 per cent x-ray, penetrant, and dimensional inspection and destructive testing of one casting from each heat of melt to sample dimensional and penetrant inspection. All castings are 100 per cent visually inspected and all casting lots require a physical or Rockwell test to check heat treat response.

X-ray inspection is one of the foundry's most valuable tools. X-ray is used to keep a constant surveillance of foundry work through daily checking of castings which are picked at random from production lots. The analysis of defects in rejected parts is, of course, another major x-ray job. X-ray also is used to test gating and risering systems to determine the best of a number of possibilities.

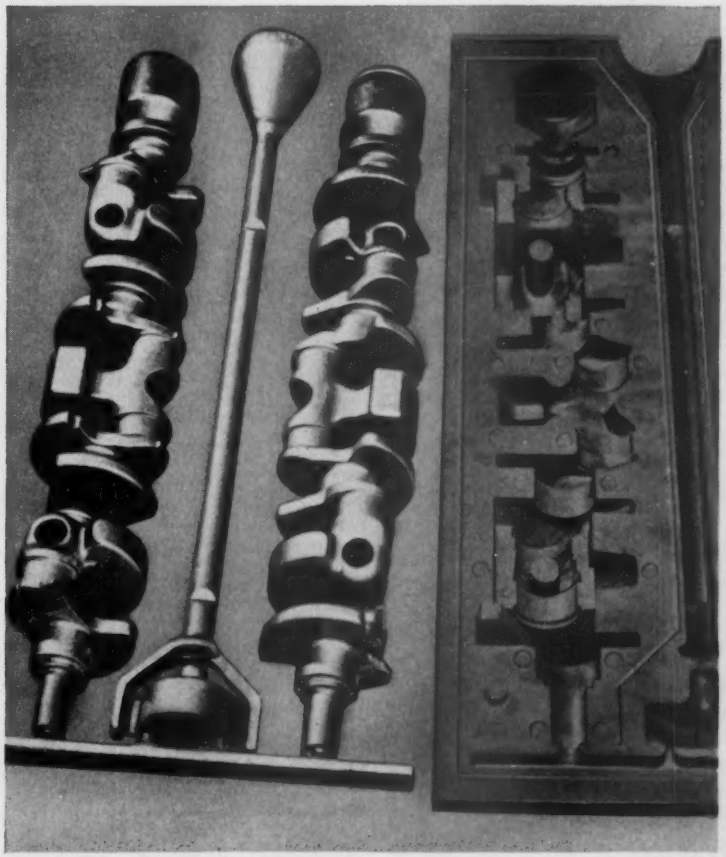
At Boeing, casting quality starts on the drawing board with the close liaison between the foundry and the engineering groups at the start of a casting design. Foundry recommendations are incorporated into the design work to reduce tooling and casting cost and casting complexity and to improve quality. This step is an important factor in Boeing's efforts to give casting designs built-in quality control. The rigid specifications to which the foundry casts, the high-strength alloys used, and the extensive inspection methods employed give quality a definitive meaning at this foundry.

Pattern shop, part of which is shown here, produces all patterns for the foundry. Wood, metal, and plastic metal equipment is produced in shop

● For an extra copy of this article, until supply is exhausted, use card on Page 39

SILICONE NEWS from Dow Corning

For Fast Get-away



Silicones Speed Production of Crankshafts for Ford Falcons

"Fast get-away" is an appropriate description for the way foundry shell molds pop free from patterns coated with Dow Corning silicone parting agents. Quick, clean and easy release every time helps assure uninterrupted production, retention of close tolerances, less machining. Here's proof from the Ford Motor Company foundry.

In one production operation, shell molds for casting crankshafts are made on a high production, multi-station rotating machine. Failure of just one shell to separate from its pattern would quickly bring operations to a halt . . . result in waste, rejects and mounting labor and material costs. But not at Ford. Their foundry engineers prescribed the right preventive medicine years ago when they settled on an emulsion of silicone as a shell mold parting agent. All it takes for good results is a light spray coating of the dilute emulsion.

In another shell mold operation Ford dips multi-unit engine valve patterns in the dilute emulsion. Even with such deep draws as are encountered with small diameter valve stems, release is clean and easy . . . production stays on schedule.

If lack of "fast get-away" is hampering your production, why not put Dow Corning Silicones on the job? Send today for a free manual detailing "how to use silicone parting agents in shell molding."

Address Dept. 4117

For complete technical information about any silicone product, contact the Dow Corning office nearest you.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

For More Information Circle 662, Page 39

INDUSTRY BRIEFS

Inland Steel Co., Chicago, has announced plans to build an ingot mold foundry at its Indiana Harbor Works, East Chicago, Ind. Construction will start this year and is to be completed in 1963. The foundry will have an annual capacity of 150,000 tons of ingot molds and will employ about 170 workers. A new electric power and steam plant is planned also.

Federal Foundry Div., Archer-Daniels-Midland Co., Cleveland, has been added to the parent corporation's Chemical Group. The change is part of an over-all reorganization to meet ADM's emphasis in the agricultural and chemical fields.

Eastern Malleable Iron Co., Naugatuck, Conn., has changed its name to The Eastern Co. The change was made as the result of an extensive diversification program. The 100-year-old company has eight divisions.

Yale Materials Handling Div., Yale & Towne Mfg. Co., Philadelphia, has appointed Briggs Weaver Machinery Co., Dallas, to be its representative in the Houston-South Texas area as well as in Dallas. James R. Shannon is in charge of the operation, and Robert Lynch is in charge of the service shop. Briggs Weaver maintains other operations in Beaumont, Fort Worth, and Dallas.

Eagle Mfg. Inc. has filed articles of incorporation to operate a foundry and general machine shop with main offices at 1112 W. Adams, Phoenix, Ariz. Incorporators are Gerald R. Dieleman, the new company's president and treasurer; William J. Quade, vice president and secretary; Harold H. Myers; and Glenn R. Myers.

Alloy Metal Abrasive Co., Ann Arbor, Mich., has appointed the following as sales representatives in the areas indicated: Alverson Engineering Sales Co., Baltimore; Barker Foundry Supply Co., Los Angeles and San Francisco; and the Sinclair Co., Houston.

Industrial Heating Equipment Association Inc. reports that new orders for industrial heating equipment in January totaled $7,291,000, up 7 per cent from the January, 1960, level. Total 1960 billings of $137,638,000 were 44 per cent higher than the total in 1959.

Borden Chemical Co., division of Borden Co., New York, plans to construct a new plant near Paris, France, for the manufacture and sale of synthetic resins to Common Market countries. The company also plans to double capacity of a subsidiary, Leicester, Lovell, & Co., Southampton, England.

Kaiser Refractories & Chemicals Div. has changed the names of two of its sales subsidiaries, Fire Brick Service Co., 1809 Cornell Ave., Indianapolis, Ind., and Fire Brick Specialties Co., 101 Seventeenth St., Rock Island, Ill. They will operate as Kaiser Refractories & Chemicals and as district sales offices.

M. Hertenstein Foundry Co., Columbus, O., ended operations in December, 1960. The foundry had been operating since 1879. All real estate and equipment is available for purchase.

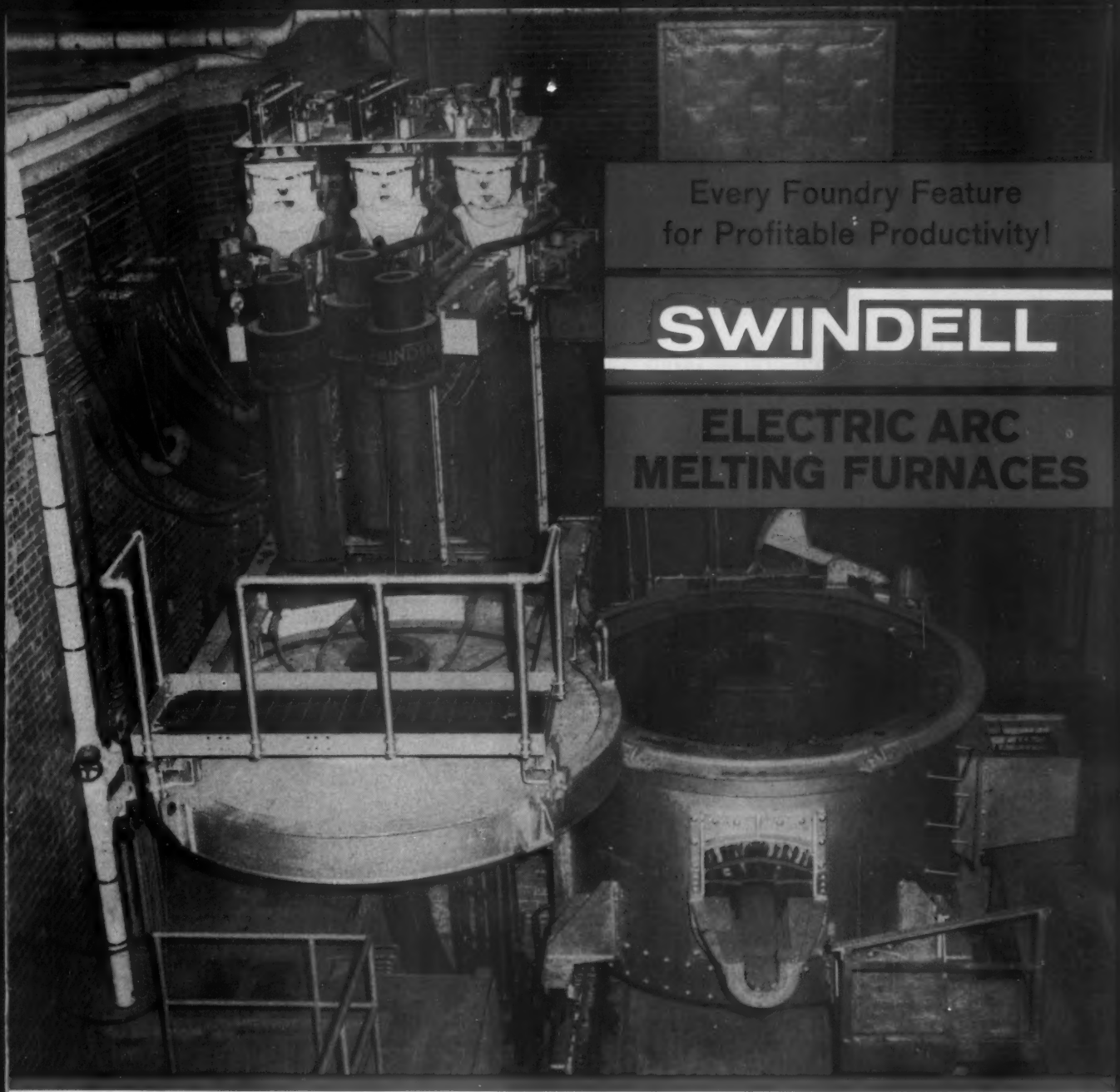
Foundry Services Inc., Cleveland, has changed its named to Foseco Inc. because of the use of its products by steel mills, smelters, and wrought metal producers as well as foundries. In addition, the new name identifies the company more closely with its product line.

Carborundum Co., Niagara Falls, N. Y., will construct a million-dollar coated abrasive manufacturing plant in Melbourne, Australia. Carborundum Australasia Pty. Ltd., a Carborundum subsidiary, now operates a plant in Sydney, and its manufacturing operations will be transferred to the new plant when it is completed late in 1961.

Foote Mineral Co., Philadelphia, has appointed Ohio Ferro-Alloys Corp., Canton, Ohio, to be its U. S. agent for the sale of electrolytic manganese metal to foundries and to secondary brass and aluminum smelters.

Frederic B. Stevens Inc., Detroit, has moved its Buffalo plant and warehouse from 93 Stone St., to 597 Northland Ave. The new buildings

NEW FOUNDRY: Narragansett Gray Iron Foundry Inc., Georgiaville, R. I., has moved into this new building. It covers 25,000 sq ft with a molding area of 120 x 140 ft. Molding is done on squeezer machines and flask sizes range up to 20 x 30 in. About 80 per cent of all cores used are CO_2 and shell types, with the remainder oil-sand. Up to 25 tons of iron are being melted daily in a new No. 6 cupola outside the building. Metal is carried inside by a spout into a 3000-lb holding ladle. The cupola has an automatic charging system



Engineering Service

Swindell-Dressler Corporation provides a complete engineering service for the ceramic industry in the design and construction of new plants, and modernization of existing facilities. Consultations arranged gladly on request.

Over and above the basic modern foundry advantages of electric arc melting are the plus features of SWINDELL furnace construction . . . full-opening, high-lift swing roof, with remote cylinder mounting . . . faster charging with flush door mechanism . . . distortion-proof 3-point roof suspension . . . expendable shell panel construction . . . safe, clean, fireproof mechanical tilting . . . and many other exclusive construction superiorities you should know about. Let us talk electric arc melting for your foundry profit—write, phone or wire!

SWINDELL-DRESSLER CORPORATION

DESIGNERS AND BUILDERS OF MODERN INDUSTRIAL FURNACES

PITTSBURGH 30, PA.

The SWINDELL-DRESSLER CORPORATION of Canada, Ltd.,
Ottawa, Canada

SUBSIDIARY OF PULLMAN INCORPORATED

For More Information Circle 679, Page 39

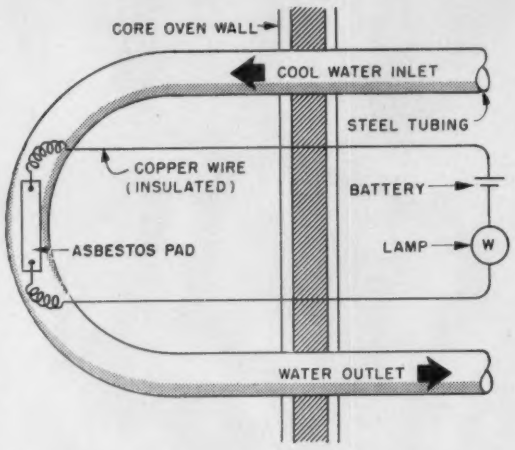
HOW TO DO IT

By TOHRU TAKI
Kubota Iron & Machinery Works Ltd.
Chuko Plant, Osaka, Japan

Simple Electrical Device Detects Humidity in Mold-drying Oven

HUMIDITY in a mold drying oven can be detected easily by using an instrument constructed as described here. An asbestos pad 1/32 in. thick, ¼ in. wide, and ¾ in. long is soaked in a salt solution and allowed to dry. This is placed on the exterior of a U-shaped steel tube of ¾ in. OD and ⅛ in. wall thickness as shown in the illustration. The tube is mounted inside the oven. Provisions are made for cool water to flow through the steel tube.

Copper wire, covered with heat resistant insulation, is attached to both ends of the asbestos strip and to a 1.5-v battery and a small lamp. When



the humidity in the drying oven is high, condensed moisture will collect on the steel tube and wet the asbestos pad, allowing current to flow in the circuit. As humidity drops in the oven, the heat will dry the pad, breaking the circuit. Therefore, the lamp going out indicates the molds are dry.

Have any ideas of your own? FOUNDRY will pay a minimum of $15 for each "How To Do It" item submitted and published

cover more than 25,000 sq ft of space, providing for shipments of foundry and metal finishing supplies direct from inventory. A new facility feature is an efficient method of grinding and bagging seacoal that will permit greater quality control.

Harcast Co. Inc., Glenolden, Pa., has appointed Mace Associates Inc., 1143 Mary St., Jacksonville 7, Fla., to be its representative in Florida, Georgia, South Carolina, North Carolina, Tennessee, and Alabama.

General Vacuum Corp. has moved from East Boston to 81 Hicks Ave., Medford, Mass. Its new plant contains about 12,000 sq ft of manufacturing, engineering, and research space.

Manhattan Rubber Div., Raybestos-Manhattan Inc., Passaic, N. J., has acquired the abrasive and grinding wheel business of U. S Rubber Co.

Radionics Inc., Norristown, Pa., has appointed Philips Electronic Instruments, a division of Philips Electronic & Pharmaceutical Industries Corp., exclusive U. S. and Canada sales agents for its entire line of gamma radiographic cameras, sources, and equipment. Radionics will continue to market its line of nuclear gages independently.

Aluminum Association reports production of 161,427 short tons of primary aluminum in January, 1961, as compared to 164,024 in January, 1960, and 165,504 in December, 1960.

Hyster Co., Industrial Truck Div., Portland, Oreg., has appointed Monarch Motors Co., North Meridian and Eleventh Streets, Indianapolis, Ind., a dealer for Hyster industrial trucks in central Indiana.

North American Refractories Co., Cleveland, began production at a new plant at Womelsdorf, Pa. A full line of basic refractories will be made there under the tradename Narmag.

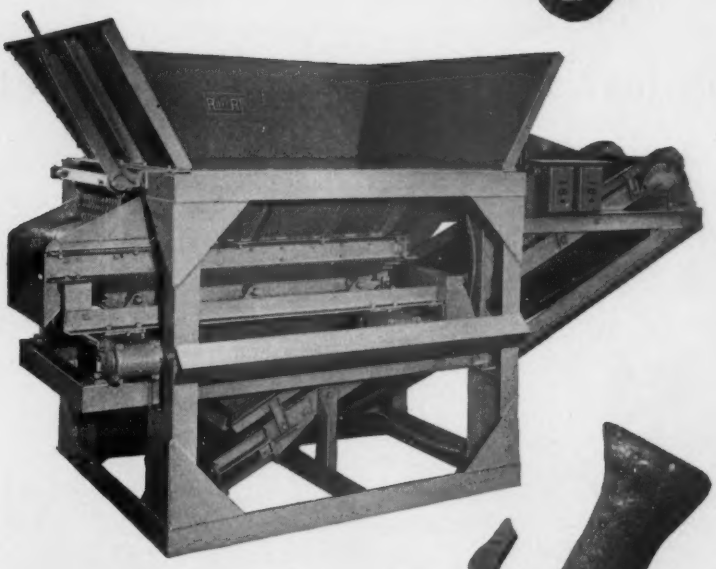
Kramer Brothers Foundry Co., Dayton, Ohio, has purchased controlling stock interest in Dayton Automatic Stoker Co., of the same city. Majority interest was purchased from Joseph F. Stenglein, former president of Stoker Co., who remains as vice president and general manager.

Jelrus Precision Casting Co., New York, has changed its name to Casting Engineers, thereby assuming the same corporate identity as its parent company in Chicago. The latter, a division of Consolidated Foundries & Mfg. Corp., purchased Jelrus some months ago.

Plymouth Die-Mold Inc., Sheboygan, Wis., manufacturer of special gears cast in zinc and other metals, has purchased a new two-story plant. Plans call for a 50 per cent expansion in labor force and factory output.

Thor Power Tool Co., Aurora, Ill., has purchased Fabbrica Italiana Apparecchi Pneumatici, Turin, Italy, largest manufacturer of pneumatic power tools in that country. Samuel P. Gartland, former U. S. sales manager, is managing director of the new subsidiary.

TRAMP TRAMP TRAMP



Model S-522-9M, one of 3 Royer Scrap Control Units

Tramp iron drops out of the picture when you install a Royer Scrap Control Unit. If you're looking for immediate savings in your foundry operations by eliminating tramp iron damage to equipment, castings *and profit*, here's a small investment with a big payoff.

Royer Scrap Controls clean up to 60 tons of shake-out sand an hour. Because they're portable and require no pit, they'll fit your mechanization plans and give production line efficiency.

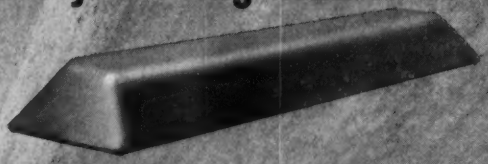
Send for Bulletin SC-61. It gives the facts and specs on the Model 522 shown and tells you about other foundry units. Royer manufactures a complete line of sand conditioning units to fit any size foundry. Contact us at 159 Pringle Street, Kingston, Penna., phone BUtler 7-2165.

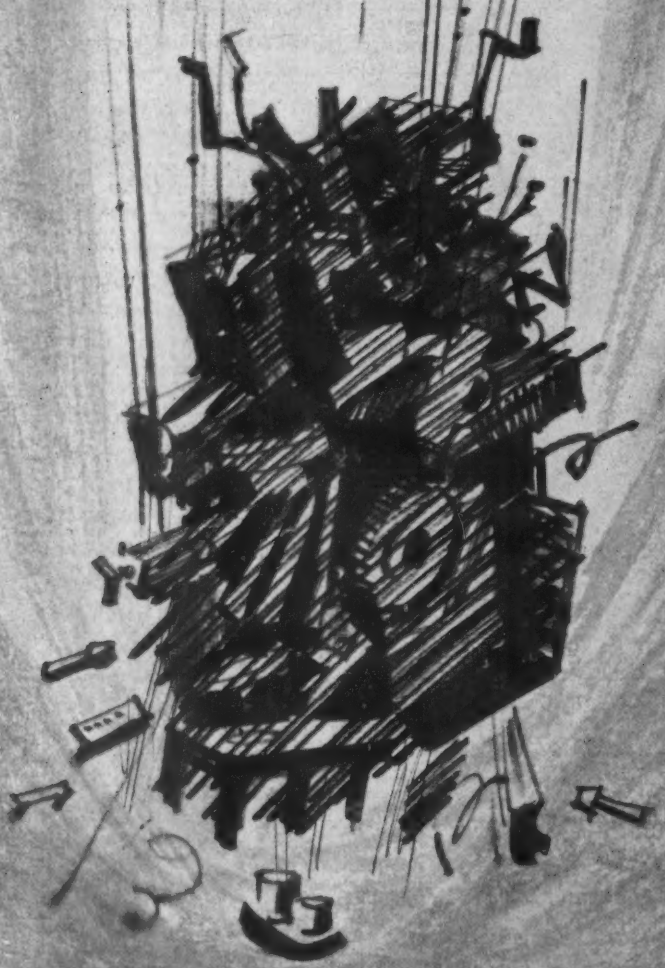
ROYER FOUNDRY & MACHINE CO.

ROYER

For More Information Circle 664, Page 39

Will your quality drop, too?..OR are you using MELTRITE!





You're gambling with purity and quality every time you substitute cast scrap for pig iron in the charge.

There's an economical way to make sure your quality is tops. We call it "CCC"—controlled cupola charge. You simply use Meltrite + steel + your own sprues and risers. This gives you a known analysis in the charge and shippable castings at the lowest possible cost. Specify Interlake's Meltrite, the 100% merchant pig iron that's always in dependable supply.

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Left, Wilson Moriarty, SFSA president, who presented society awards to, from left to right, winners Thomas S. Quinn Jr., J. D. Hagans, and Dale L. Hall

STEEL FOUNDERS' SOCIETY

Looks to Future Years of Progress

By WILLIAM G. GUDE
Editor

● STEEL Founders' Society of America, at its annual meeting held in the Drake, Chicago, March 13-14, marked the 100th anniversary of the pouring of the first steel casting in America. It also considered the business outlook and discussed society programs intended to accelerate progress in the steel castings industry.

Society president Wilson H. Moriarty, vice president and group executive, National Malleable & Steel Castings Co., Cleveland, indicated that the industry believes steel castings production will increase in the third quarter and will experience a marked upturn in the final quarter of the year. Production in 1960 was 1,392,385 tons compared with 1,413,000 tons in 1959. Output in 1961 should continue in that general area. Heavy construction machinery manufacturing currently is the active market for steel castings.

Future Needs—In reporting briefly on the major activities of the society, Mr. Moriarty stressed particularly the importance of the advertising program which has been under consideration, and the need for a much greater research, development, and cost reduction program. After discussing the steel castings research programs in France and Great Britain, Mr. Moriarty suggested a plan for financing the expanded research program and outlined a method of conducting the program through five groups of foundries, based on size. He urged careful consideration of the project.

Speaking on "The Association of the Future," F. Kermit Donaldson, executive vice president, SFSA, stated that today the great function of the trade association is to act as the eyes and ears of its membership. Out of the continually revolving kaleidoscope of economic affairs, the trade association must do what the individual cannot do—namely, select that information which is pertinent to the member's affairs, digest it, interpret it, and then transmit it in such a fashion that the member can absorb it quickly. The effective trade association must be prepared at all times to make a cumulative evaluation of facts that are gathered, and often initiate both constructive and defensive joint effort based on the evaluation.

A Middle Ground—After considering the competency of man to manage even the complicated world which he has invented and developed, Mr. Donaldson pointed out there is a middle ground between placing complete responsibility and commensurate authority on the individual, or delegating it to government. This middle ground is the voluntary association. This is the device which has been developed, in the Steel Founders' Society particularly, wherein a group of people, recognizing that there are problems

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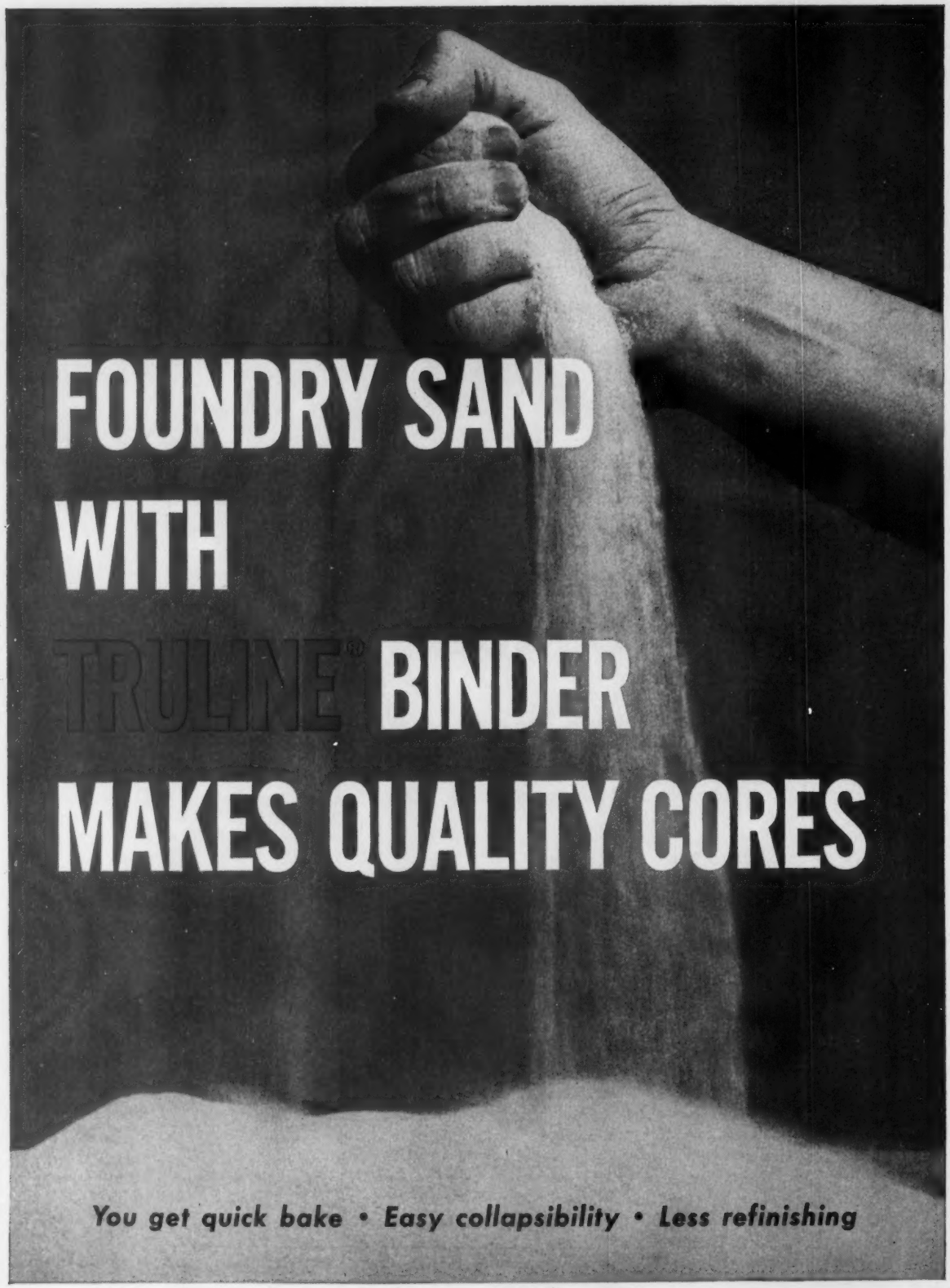

Naval Stores Department

HERCULES POWDER COMPANY

INCORPORATED

Hercules Tower, 910 Market Street, Wilmington 99, Delaware

NF61-1

James D. Holtzapple, left, presents certificates of safety to, left to right, Emil Veselik and Dale Hall

Frank G. Steinebach, right, receives an award of honor from Wilson Moriarty, SFSA president

at hand which transcend the capabilities and resources of individuals, have banded themselves together to pool resources, energies, ideas, and leadership to accomplish a common goal.

Mr. Donaldson concluded that during the next several years business again will be on the defensive. The association of the future either will meet the challenge and cope with it, or there will be no future for the association and a gloomy one for its members. Based on the proven competency of the leadership of the past and the heritage they have passed on to the society, and the caliber of young men of the industry, he has no fear of the competency to meet future problems.

Recession at Bottom—Dr. Pierre Rinfret, vice president and director of Economics Department, Lionel D. Edie & Co., New York, predicted a pickup in business during the third quarter, a good fourth quarter, and a first quarter of 1962 that will establish or smash every record that was developed in 1960. He pointed out that this is an inventory, not a capital goods, recession, and that it has reached bottom. Furthermore, government spending during the next few years will show the biggest increase since 1954. Federal, state, and local spending will go up by equal units.

The decade of the sixties will be one of change, according to Dr. Rinfret. A major change will be in the population mix which will add 9 million people to the 18-24 year age group. The labor shortage definitely is over, and unemployment will continue to be high for five years. This decade also will see fantastic shifts in capital investment in this country, greater attention to research, the development of many new industries, a continuation of the trend toward manufacturers carrying more inventory, and the growth of the United States as a free trade country. In conclusion, Dr. Rinfret emphasized that the steel foundry industry should step up its investment in research and development. Capital investment should be stepped up to cut the unit cost of production.

Personnel Important—The importance of personnel to a foundry's success was stressed by Dale L. Hall, works manager, Oklahoma Steel Castings Co., Div. of American Steel & Pump Corp., Tulsa, Okla., in speaking on "Change Is Certain—Progress Is Planned." This importance becomes evident from the fact that labor represents about one-half the cost of the product the foundry sells. Moreover, the attitude of labor can influence 65 per cent of the defects to which castings are subject.

Foundries should seek business requiring the degree of quality which they are able to furnish. The producer is courting trouble when he attempts to sell above or below the quality bracket in which he specializes.

Mr. Hall described a relatively simple method for determining manhour requirements in various operating departments for a given class and volume of work.

Promotion Needed—The casting process itself offers possibilities of exceeding the benefits of the so-called "revolutionary" foundry processes, provided it receives the proper promotion, according to John B. Caine, foundry consultant, Cincinnati. Speaking on "Casting Design in the Future," he said that either the reports on the advantages of steel castings and casting design are not being distributed widely enough or they are being distributed to the wrong men. Further, it is imperative that steel casting salesmen sell engineering personnel as well as purchasing people. "We must get to know the men who decide whether a part is to be cast, forged, or fabricated," he emphasized.

The Next Ten—Status of the steel foundry industry 100 years from now will be influenced largely by what progress is made during the next decade, it was stated by Frank G. Steinebach, publisher and editorial director, FOUNDRY, in discussing "The Next Ten." He said that the industry's greatest need is for management of every company to learn the fundamentals and the many re-

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finements in the field of marketing.

This field encompasses not only the on-time delivery of a consistently good product, but also the broad aspects of advertising and public relations, product and market development, and technical research. The speaker also recommended the adoption of a comprehensive study to determine where steel castings can be substituted for other products and extent of the market potentials in new industries.

At the conclusion of his talk, Mr. Steinebach was presented a plaque honoring him "for his many years of inspired and devoted service to the foundry industry and for the unselfish, co-operative spirit which has always characterized his association with Steel Founders' Society of America and the entire Steel Casting industry."

The concluding morning program had three talks, which followed the showing of the film, "Rice Bowls to Rockets," produced by the Gray Iron Founders' Society.

"Remarks by Counsel" was given by Chauncey Belknap, legal counsel of the society. "A Blueprint for Businessmen in Politics—Post 1960," was discussed by Willard V. Merrihue, manager, Community and Business Relations, General Electric Co., New York. "Profitable Pricing for Foundry Products" was the topic of Bertrand J. Belda, partner, Ernst & Ernst, Cleveland.

Awards—Four men were honored during the meeting for outstanding achievements in the steel casting industry. J. D. Hagans, sales manager, Springfield, Ohio, plant, Ohio Steel Foundry Co., was awarded the Frederick A. Lorenz Medal. A charter member of the Product and Market Development Committee, he has been active in society work since 1930.

Dale L. Hall, Oklahoma Steel Castings Co., received the Technical and Operating Medal. He is chairman of the SFSA Technical and Operating Committee. A technical paper by O. W. Kramer, metallurgist, Columbia Steel Casting Co., Portland, Oreg., and W. A. Snyder, associate professor, University of Washington, Seattle, took top honors in the annual Gustav A. Lillieqvist Steel Foundry Facts Awards. Their paper, presented in *Steel Foundry Facts*, discussed use of olivine sands for molds and cores. Second-place honors went to T. S. Quinn Jr., Lebanon Steel Foundry, Lebanon, Pa., for his paper, "Pressure Pouring of Steel Castings."

Four member companies were honored for achievements in safety work. Awards for extended periods of accident-free operations were presented by SFSA Safety Committee chairman J. D. Holtzapple, Blaw-Knox Co., Pittsburgh, to the following: Eastern Co. (formerly Eastern Malleable Iron Co.), Wilmington, Del.; Calumet Steel Castings Corp., Hammond, Ind.; Tonawanda Electric Steel Casting Corp., North Tonawanda, N. Y.; and Oklahoma Steel Castings Co., Tulsa, Okla.

Election of Officers—W. H. Moriarty was re-elected president of the society for the coming year. Robert M. Schumo, president, Pennsylvania Electric Steel Castings Co., Hamburg, Pa., was elected vice president. W. P. Dudley, vice president and general manager, Springfield, Ohio, plant, Ohio Steel Foundry Co., was

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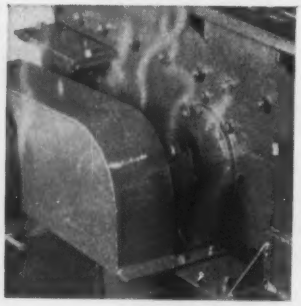
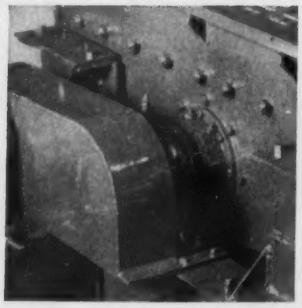
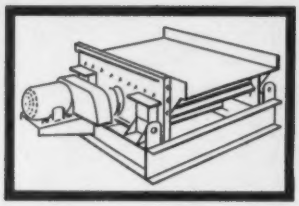




Ordinary Grease Drips Away



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A large production malleable foundry's report shows that **Ironton AL-70** brick lasted 826 hours in an air furnace bottom where metal is tapped at 2830°F. With pulverized coal as fuel, 70% alumina brick stands the gaff better than any refractory used previously.

On a basis of cost per ton of metal produced, **Ironton AL-70** brick are most economical. Longer service and superior resistance to slag and metal attack help to reduce over-all costs of furnace operation. Check this opportunity for savings.

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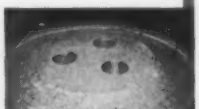

in electric furnace roofs to **Ironton AL-70** brick. In this application, high alumina brick really cuts costs. Ask for details.

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MANUFACTURE AND SALE OF IRONTON PRODUCTS NOW A RESPONSIBILITY OF

NORTH AMERICAN REFRACTORIES CO.

Cleveland 14, Ohio

For More Information Circle 670, Page 39

named to serve with Messrs. Moriarty and Schumo on the Executive Committee. R. G. Parks, treasurer, National Malleable & Steel Castings Co., was re-elected SFSA treasurer.

Erwin Dieckmann, recently assistant secretary, was elected secretary. Other staff members re-elected were F. Kermit Donaldson, executive vice president; Charles W. Briggs, technical and research director, and George K. Dreher, market development director.

Standard Lengths Are Proposed For Coated Abrasive Belts

Standardization of lengths of coated abrasive belts has been the object of a recent campaign by the Coated Abrasives Manufacturers Institute. Under existing specifications, 104 different belt lengths are manufactured in lengths from 12 to 168 in. A committee sponsored by the institute has recommended that belts be manufactured in 31 lengths; in 3-in. increments from 12 through 36 in., and in 6-in. increments from 42 through 168 in.

Machine specifications collected by the committee indicated that of the 278 belt-using machines now in production, 154 use one of the 31 proposed lengths. The committee reportedly has asked the manufacturers of the remaining 124 machines to consider revising or adjusting them to accept the nearest proposed belt length, and to follow the new standards when designing a new machine. Thus far, the machine industry has been almost unanimous in its willingness to co-operate.

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The higher the alumina content, the better the service in a special high alumina refractory for tough applications up to 3300°F. **Ironton HI-AL** means longer service . . . with lower refractory cost for the life of the lining in acid electric ladles, in tapholes, electrode openings, reverberatory furnaces, for lining and patching acid electric furnaces and repair jobs.

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For More Information Circle 671, Page 39

Zircons are unaffected by temperatures which melt silica sand—and are not wetted by molten metal. Finer, rounder zircon grains of much lower thermal expansion provide closer dimensional control and smoother sand-free surfaces. Because zircon sand removes heat four times as fast as silica sand, it offers new foundry techniques for handling deep pockets, thin cores, metal impingement areas and other special problems.

Rapidly expanding foundry use of zircon ranges from surface dusting and washing of regular sand molds with zircon flour, through use of zircon 'insets" for directional solidification in special areas, to complete replacement of molding sand by zircon sand in special high-speed, high-accuracy casting operations. Zircon outperforms silica sand in each case.

Unusual purity and uniformity is guaranteed by the Orefraction trademark on each bag. Write us for the names in your area of foundry suppliers for Orefraction products of Metal & Thermit. They can help you in developing new and profitable molding techniques with zircons.

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M&T Foundry Zircons include:
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ALUMINUM AND
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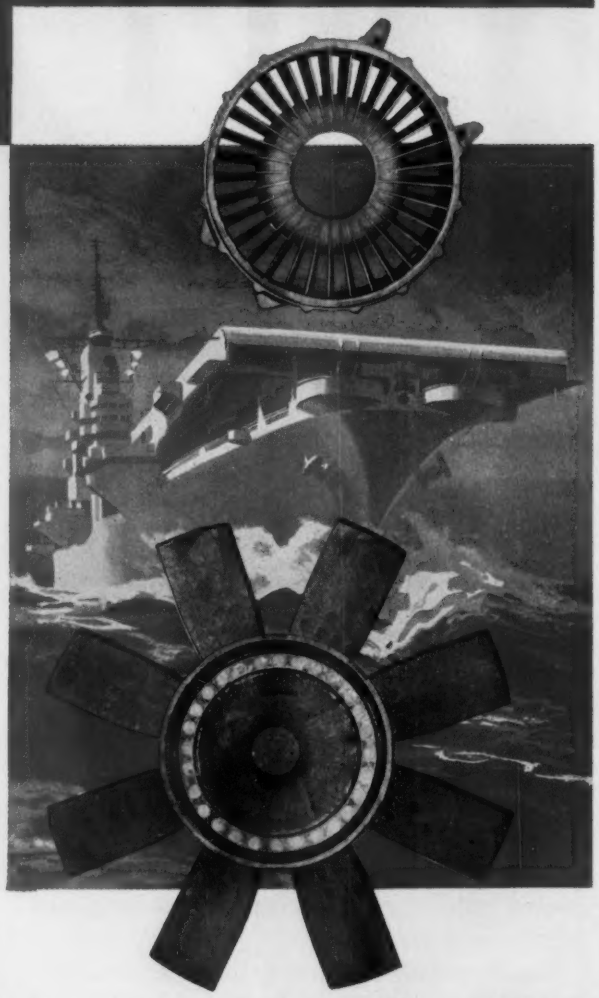

JOY MANUFACTURING COMPANY, New Philadelphia, Ohio, has been using PETRO BOND waterless molding sands since 1956. A continuous PETRO BOND user since then, JOY has found they can consistently produce fine-finish castings like the fan and blower casing illustrated here. PETRO BOND's smoother surfaces reduce finishing costs . . . give closer tolerances . . . fewer rejects.

PETRO BOND sands are bonded without water . . . permitting the use of fine-grain sands because of less gas. Molds shake out fast, sand doesn't stick to castings.

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Book Reviews

Cobalt, Its Chemistry, Metallurgy, and Uses, edited by Roland S. Young, hard cover, 424 pages, 6 x 9 in., published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $15.

Text has been drawn together from writings of leading authorities on cobalt and related fields. Of interest to metallurgists and foundrymen are chapters on cobalt's chemical and physical properties, phase diagrams, applications, and analysis procedures.

The many specific topics covered include magnetic, electrical, electronic, high temperature and high-strength, and tool steel applications.

One chapter on radioactive cobalt deals extensively with the radioisotope cobalt 60, which is used for gamma radiography. This chapter includes a list of indexes and guides which cover the availability of radioisotopes.

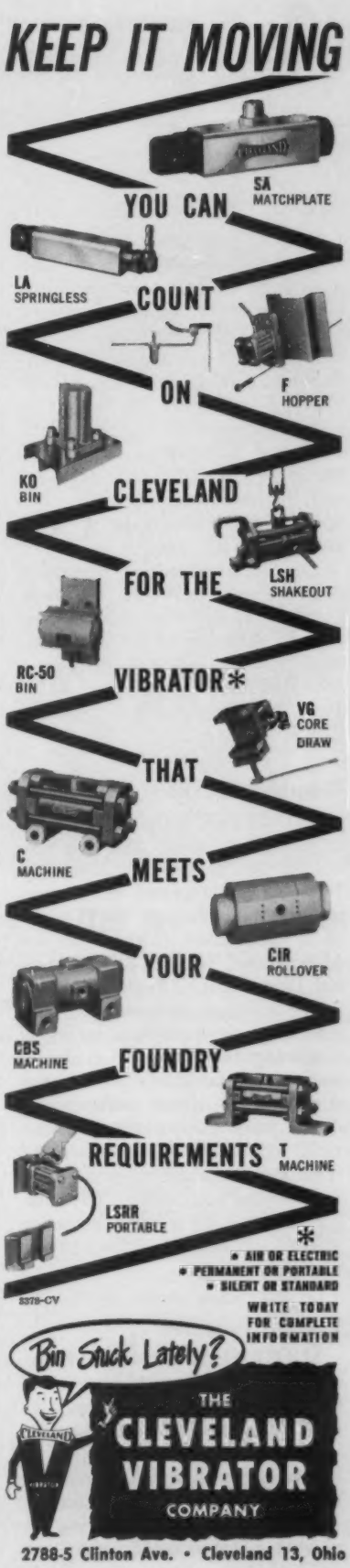
In all, there are 17 chapters, each of which includes a list of references which provides many additional sources of information about cobalt, its properties, and its applications. About 45 figures and 50 tables supplement the text material.

Industrial Electric Furnaces and Appliances, by V. Paschkis and John Persson, cloth bound, 600 pages, 6 x 9 in., second edition, published by Interscience Publishers Inc., 250 Fifth Ave., New York 1, N. Y. Price $24.

This edition combines the two volumes of the first edition and includes expanded and revised subject matter.

The first chapter deals with economic considerations, heat transfer, and electrical laws. Subsequent chapters cover arc furnaces, resistance furnaces and applications, and induction and dielectric heating. The last chapter serves as a general guide to selection of the proper furnace for a particular application.

Discussion of furnace design in this text is concerned mainly with thermal and electrical problems. Equations and sample calculations are included to cover the necessary electrical and heat transfer computations. Over 400 photographs, schematic drawings, and graphs supplement the text material.



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Russian Practices

SOVIET practices in casting aluminum and magnesium alloys are described in a translation of a two-volume manual available from the Office of Technical Services, Business and Defense Services Administration, U. S. Department of Commerce, Washington 25.

Translated by the U. S. Air Force Technical Information Center, the handbooks contain 407 pages of text, figures, tables, formulas, and an extensive bibliography of Soviet and foreign literature.

The work is entitled *Handbook for the Foundry Worker — Shape Casting of Aluminum and Magnesium Alloys* by *I. F. Kolobnev.* Part 1 on aluminum, designated No. 60-21972, is priced at $3.50. Part 2, on magnesium, No. 60-21973, is $3.

Graphite Injection

INVESTIGATION of graphite injection into the cupola was conducted by Leyshon, Coates, and Nicholas and reported in "Graphite Injection Through the Tuyeres of a Cold Blast Cupola" in the March, 1961, issue of BCIRA Journal (Birmingham, England).

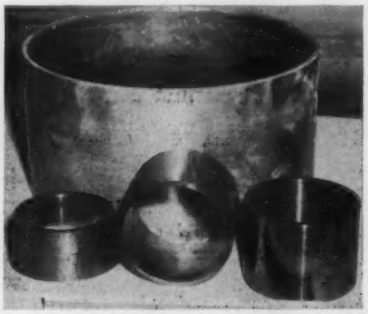
The authors indicate that the practice could provide a means of producing two or more grades of iron from a standard cupola charge. A given grade of iron could be produced from cheaper charge materials. Higher carbon-equivalent irons can be obtained under normal melting conditions. The process may provide a rapid reduction of chill and possibly influence other casting properties.

Casting Tungsten

SUCCESSFUL melting and casting of pure tungsten is reported by Oregon Metallurgical Corp., Albany, Oreg. Melting point of tungsten, 6170° F, is the highest of the known elements, and the metal was melted in a vacuum arc furnace using the skull-melting process, employing a water-cooled copper crucible to contain the molten metal.

The tungsten was cast by the centrifugal process into hollow cylinders or rings as shown in the foreground of the accompanying illustration. The large cylinder in the back is molybdenum.

It is said that the melting and



casting process for tungsten results in a finer grain structure as well as substantial economies in producing shapes.

Aircraft Casting

STAINLESS steel casting weighing about 25 lb, and produced by the investment casting process is being used as a critical load-bearing unit in the main landing gear of the country's fastest commercial jet transport.

The part is an uplock bracket, the primary component of the left and right uplock assembly of the main landing gear unit of the Convair 990. It must meet class AA requirements, the highest performance classification. Steel is type 410 (12 Cr) stainless, heat treated to a minimum tensile strength of 200,000 psi.

Castings are in production at Precision Castparts Corp., Portland, Oreg., and supplied to Cleveland Pneumatic Tool Co.

Measures Properties

AN ELECTROMAGNETIC instrument which measures dynamic mechanical properties of materials will be manufactured and distributed by Chesapeake Instrument Corp., Shadyside, Md., under license from the Wisconsin Alumni Research Foundation.

Developed by Dr. E. R. Fitzgerald and Prof. J. D. Ferry, the instrument is capable of predetermining many of the properties which may influence the behavior of metal, elastic, plastic, and other substances when exposed to vibration, shock, wear, and various other stresses.

New Iron Contains Low Level of Impurities

● IMPURITY LEVELS of a low order feature a relatively new ferrous material.

Product of a Canadian direct-reduction process which treats a mixed hematite and ilmenite ore, the iron is available in pig iron or shot form in two grades, 2.25 or 4.25 per cent C. Both grades contain about 0.02 S, 0.025 P, 0.08 Si, and 0.009 Mn. Typical residuals include 0.035 Cr, 0.025 Cu, 0.085 Ni, 0.020 Ti, 0.025 V, 0.040 Co, 0.015 Al, and 0.001 each of W, Mo, and Sn.

It is claimed that in the production of ductile iron the low silicon content of the material permits the charging of returns without silicon buildup, and the low manganese helps to provide a fully ferritic structure. The low residual content also aids in holding down "subversive" elements through dilution. The combination of high carbon C with low silicon, phosphorus, and sulfur and low residuals is helpful in production of special alloy gray iron, malleable cast iron, and steel.

The iron, produced by Quebec Iron & Titanium Corp., Sorel, Que., is called Sorelmetal, and is offered in this country by Miller & Co., Chicago.

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1 **Customer Service,** ready as your phone, brings Union Carbide Metals' field engineers to your melting plant—from any of 9 sales and service offices. In providing on-the-scene assistance, they gladly make available UCM's integrated experience in the application of ferroalloys to various melting practices.

Lately, their travels to mills and foundries have soared to well beyond the million-mile mark—each year! This customer service is just one of the 5 intangible but ever-present extra values of UCM's FIVE-DEEP alloys which mean better products and bigger profits for you. The others:

2 **Technology**—many million dollars worth a year—helps you produce better, more profitable metals. UCM's 600-man research and development center is the birthplace of hundreds of new alloys.

3 **Unmatched Facilities** free you from delivery worries. Only UCM gives you 6 plants—3 with their own power facilities—and 17 warehouses, all located for fast shipments by rail, truck, or water.

4 **Global Ore Sources** assure you uninterrupted supplies of ferroalloys. UCM's close association with world-wide mines provides dependable raw material sources.

5 **Strictest Quality Control**—with over 100,000 tests per month from mines to shipment—makes sure you always get alloys of uniform size and analysis, with minimum fines, lot after lot.

For better metals, production economies, bigger profits, insist on UCM's FIVE-DEEP alloys. Union Carbide Metals Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y., producer of "Electromet" brand metallurgical products.

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Only ELECTROMET ferroalloys from UCM are so deep in extra values to help you.

For More Information Circle 675, Page 39

Gating and Risering Investment Castings

This article, twentieth in our gating and risering series, concludes the discussion of investment castings which started last month

By HYMAN ROSENTHAL
Metallurgist
U. S. Army Ordnance, Frankford Arsenal
Philadelphia

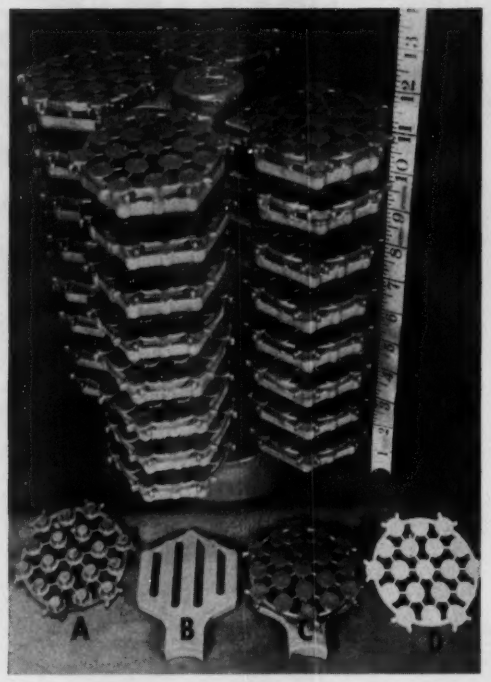

Fig. 9—Setup required to make casting D. Pattern includes gate stubs as at A; special runner is shown at B, and the pattern-runner assembly is at C

● THE GENERAL importance of feeding distance is shown by Wilcox's data on carbon steel.[2] End-gated test bars were inferior to a keel block gating design because of feeding distance considerations. Adams has pointed out that, with a uniform section, feeding distance will increase with increasing mold temperature.[3] Quantitative data on this effect has been obtained by Present.[4] Round rods were top poured in AISI 1020 steel using the pouring basin as the riser. The pouring basin was large enough to be considered infinite relative to the rods. Soundness was judged by x-ray standards. Results are shown in Table II.

It can be seen that the feeding distance is increased almost 50 per cent by raising the mold temperature from 1200° F to 2000° F. Present has shown that pouring temperature also influences feeding distance. These experiments were made similarly to those just described, but using Armco iron at pouring temperatures of 3000° F and 3300° F. An addition of 0.10 per cent silcon was made to the iron for castability. Results are listed in Table III. The added 300° F superheat to the metal more than doubled the feeding distances.

To investigate the effect of alloy freezing range, Present compared Armco iron with AISI 1020 and AISI 1095 steels. These alloys were cast with a pouring temperature of 3000° F into a 1600° F mold. As indicated in Table IV, a pronounced increase in apparent feeding distance exists with increased carbon content. However, there is also a concurrent tendency to go from concentrated to dispersed shrinkage in the specimens. With dispersed shrinkage, detection by x-ray is more difficult so that analysis of the data is complicated.

With reference to metal pouring temperature and mold temperature, disadvantages must be considered before temperatures are raised arbitrarily to gain increased feeding distance. Both mold and pouring temperature increases will delay solidification of the castings. This will have an adverse effect on the mechanical properties of the metal since the properties are influenced by the coarseness of the cast structure.

Grain size, dendrite arm spacing, precipitate size, and gas evolution are sensitive to solidification time. When those factors interfere with heat treatments they have an indirect but potent effect on mechanical properties of the castings.

Fluid Flow—Recent water analog studies of gating by Battelle Memorial Institute emphasized the importance of fluid flow considerations in gating. The studies show that the gating system must fulfill certain geometrical requirements to minimize metal turbulence and air aspiration. Tapered sprues, wells at the bases of sprues, and properly proportioned runners contribute to the orderly, quiet flow of metal necessary for optimum casting quality.

McCullough, Webbere, and Thomson[5] have used the water analog technique in a study of investment casting gating. They were concerned with stress rupture properties in a high temperature nickel-base alloy cast in a Merrick[6] inversion furnace. Their final design for a mold containing six test bars was similar to the vertical gating system evolved by Battelle.

The test bars are aligned ver-

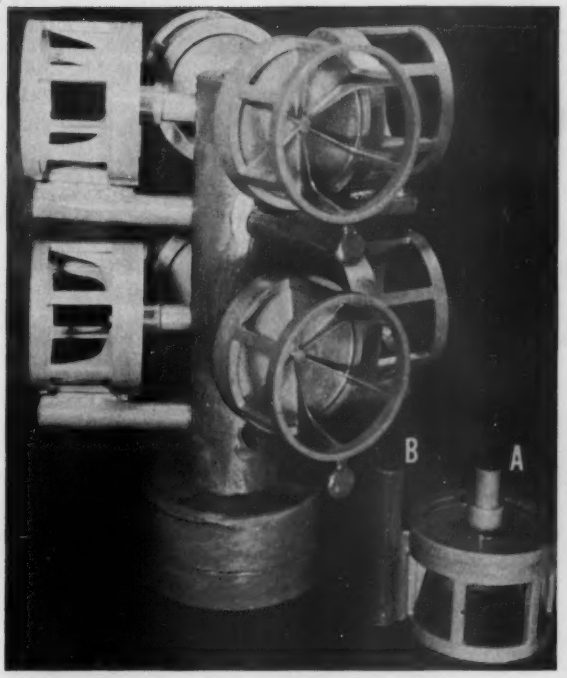

Fig. 10—Pattern for stainless steel casting includes gate pad A and Runner B

Fig. 11—Finished casting B requires four runners as shown on the wax pattern A

tically in two rows of three bars per row. A curved sprue connects the pouring basin with the bottom runner which lies between the rows. There is a vent from the end of this runner to the top of the mold as in the Battelle model. Individual cross runners connect the main runner with the bottom of each test bar. Each test bar has its own attached riser at the top. The risers are tied to a runner leading to the pouring basin.

In this design, pouring by attaching the mold to a furnace and inverting has simplified some of the problems of vertical gating. A tapered sprue, for example, is not necessary since the stream of metal running down the sprue is controlled by the rate of rotation. In addition, the rotation of the mold automatically causes all the metal to run down the sprue until the mold is almost horizontal. Then, the second opening leading from the pouring basin to the risers is activated. Thus, hot metal is fed into the risers exactly when needed.

Stress rupture properties of test bars from this gating system showed considerable improvement over a previous system. Not only were the properties considerably improved, they also were in a much narrower band.

Riddihough[7] has emphasized the importance of controlling the pouring operation with a Merrick[6] furnace. To overcome turbulence, he advocates careful design of the furnace interior and throat; reproducible inversion rate by a motorized mechanism; and gating with the sprue positioned to receive the metal in a Durville manner.

Ladles or standard tilting furnaces may be used for the static pouring of molds or for pouring them on a suction table or in a vacuum chamber. For these pouring methods, as in the case of most investment molds, the sprue or sprues generally serve also as risers. Either parallel-sided or tapered sprues are used in production. Because of the small size category in which most investment castings fall there is some doubt as to the usefulness of a tapered sprue to help in pressurizing the gating system to the point where the pouring basin can be kept full.

In recent years, however, the

TABLE II — Effect of Mold Temperature on Feeding Distance*

Bar Diameter (in.)	Length of Bar (in.) Cast Sound at Mold Temperature of: 1200° F	1600° F	2000° F
¼	1½	2	2½
⅜	2	2½	3½
½	3	3	4½
¾	4½	5	6
1	6	6	...

*AISI 1020 steel poured at 3000° F in solid investment molds[4]

TABLE III — Effect of Pouring Temperature on Feeding Distance*

Bar Diameter (in.)	Length of Bar (in.) Cast Sound at Pouring Temperature of: 3000° F	3300° F
¼	0	2½
⅜	1½	3
½	1½	4
¾	2	5½

*Armco iron cast into solid investment mold at 1600° F[4]

TABLE IV — Effect of Alloy Freezing Range on Feeding Distance*

Bar Diameter (in.)	Length of Bar (in.) Cast Sound with Indicated Alloys: Armco	AISI 1020	AISI 1095
¼	0	2	2½
⅜	1½	2½	2½
½	1½	3	4
¾	2	5	6

*Solid investment molds at 1600° F poured at 3000° F[4]

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casting of larger parts has become practicable. This is especially true since development of the shell investment process which has made possible the casting of parts in the 50 to 100-lb range. The use of tapered sprues and other arrangements to pressurize the gating system has increased for the larger size castings.

Additional study is required to elucidate the significance of gating system variables for the category of small parts in which most investment castings fall. In any gating system there is a transient, unsteady state before equilibrium flow conditions are established. The question is whether this equilibrium state can be obtained in a practical manner before the relatively small mold cavities are filled.

Fig. 12—This 416 stainless steel part requires nine vertical sprues and 22 runners. Sprues are 1 in. in diameter, and offshoots are smaller

Effect of Pouring Method—One of the most valuable attributes of the investment casting process is its ability to make highly detailed, smooth, intricate castings. To produce such castings, three conditions must be maintained: Rapid and nonturbulent flow of metal, a fine refractory surface on the mold walls, and warm or hot molds.

The use of fine refractories to obtain the desired casting smoothness tends to reduce mold permeability. Poor permeability reduces the velocity of metal flow in gravity-poured molds by impeding the displacement of the air in the cavity. The problem can be reduced by using vents. However, the flow of metal seals off and isolates parts of the cavity from which air can escape only through the interstices of the refractory.

When the incoming metal does not have enough force to drive the air out rapidly, the falling temperature of the metal causes it to freeze prematurely, resulting in a misrun. Higher pouring temperatures or higher mold temperatures may be effective in overcoming misruns. The problem also can be reduced by pouring molds on a suction table, in a vacuum chamber, or by applying air pressure to the metal in the sprue.

Gating design for static pouring should incorporate as many vents as possible located where the maximum volume of air can be removed. Patterns should be oriented to avoid as much as possible the isolation of air pockets. Finally, the gating system should favor height to gain greater hydrostatic pressure from the metal as well as to increase the velocity of the stream to drive air out of the mold cavities.

Vacuum Aids Filling—A special instance of gravity pouring is the pouring of molds in a vacuum chamber. The filling power of the metal when it is unopposed by mold air is a remarkable demonstration of the importance of permeability.

The use of suction devices for casting is effective in helping to remove mold cavity air and in utilizing atmospheric pressure to force the metal into the mold. However, it would be a fallacy to believe that any suction device operating through the investment of solid molds can evacuate the air from a large mold cavity in the time required. Large mold cavities should be vented directly.

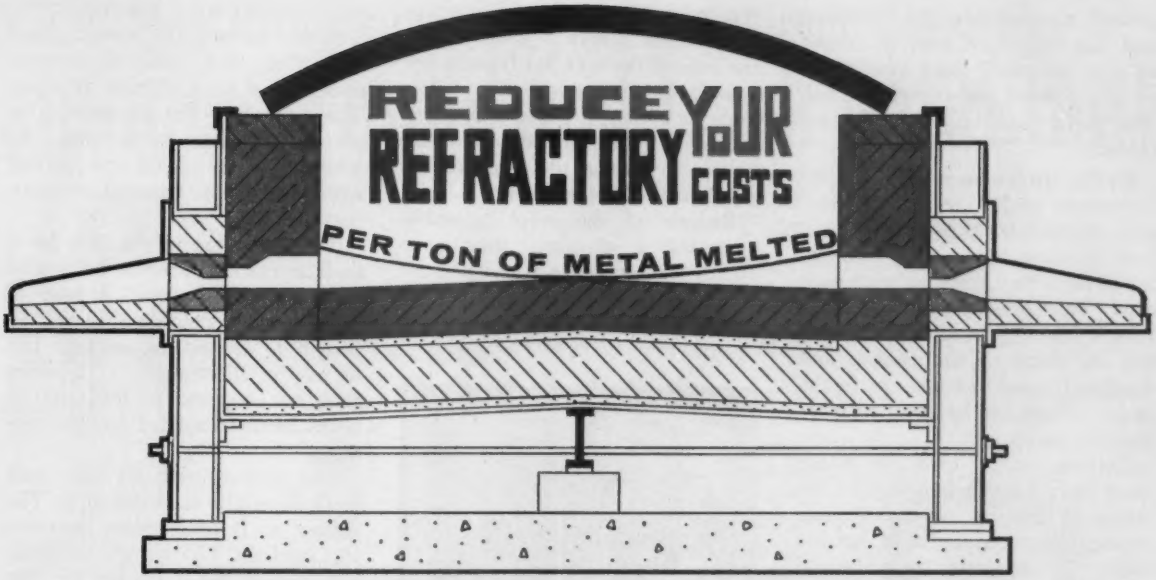
Centrifugal force may be used to increase metal velocity and pressure. The flask may be spun about its own axis or attached to an arm which is spun about a vertical or horizontal axis. Gating for centrifugal casting should be designed to channel the metal in the direction of the centrifugal pressure. Runners leading from the sprue should incline from the sprue with the least angle.

The patterns should be oriented so that they fill with the metal still traveling under centrifugal acceleration. The centrifugal pressure pattern developed in a mold after the cavities are full of metal is not uniform. The pressure is at a maximum at the head of the flask and diminishes to a low value in the vicinity of the heel.

Blow-outs are a common type of failure in centrifuged flasks. Thus, the configuration of mold cavities, especially near the head of the flask, should be arranged to avoid undue weakening of the investment. Large, flat, mold surfaces should be oriented vertically rather than horizontally in the flask. The pressure developed by the liquid metal is supported more efficiently by the flask wall than by the open end of the flask.

The Merrick[6] furnace combines the melting and casting functions for investment molds. After melting, the flask is clamped over the furnace and the furnace is inverted. This arrangement dictates the use of setups which utilize the entire melting capacity of the furnace, ordinarily 10-20 lb.

The Durville Process is a method of introducing metal into a mold with little turbulence. The sprue is in a horizontal position with a container to receive the molten metal at one end of it; both are on a horizontal arm that can rotate about a fixed point. Metal is



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poured into the receiving container, and the horizontal arm is rotated so that the metal flows quietly out of the receiver and into the mold. The mold ends up below the receiver.

Gating Investment Shells—Shell investment molds are made by several dippings of the pattern setup in a refractory slurry with a stuccoing of refractory grain between each dip. Thickness of the final shell ranges from $\frac{1}{8}$ to $\frac{1}{2}$ in., depending on shape of the casting and weight of metal to be poured in the mold. Flasks are not used in making the molds.

Pattern setups used for shells must endure much handling in the series of dipping, stuccoing, and drying operations to build up the shell. Consequently, the structural strength of the gating system is important. Also the spacing of patterns and gating components must be wide enough to allow for the final shell thickness. If spacing is inadequate, the alternate dipping and stuccoing operations are hindered. Liquid or air may be entrapped behind a dip coat layer with the danger of metal breakthrough during pouring of the mold.

Because flasks are not used to form the mold, greater freedom exists in gating and pattern positioning on the setup. In an investment shell, gating components have no more refractory mold material around them than do the patterns. Considerably more heat is lost through the walls of the shell than through the bulk of investment in a solid mold. Compensation must be made for the heat loss by making the gates and runners thicker than is general practice for flask molding. On the other hand the chilling action obtained from fast metal cooling in the shell can be used to advantage.

The removal of heat-disposable pattern and gating system material from shells must be considered in the design of the gating system. Compensation must be made for the large bursting force of the expanding pattern material as it becomes hot enough to melt and slip from the green shell. Sprues, gates, and runners are rounded and filleted to avoid stress raisers and to provide easy egress of the pattern material. Flash firing is used to melt the pattern material at the mold interface first so that it may flow out before the bulk of the wax has become hot enough to expand greatly. Patterns for sprues, runners, and heavy casting sections sometimes are made hollow to reduce the force of expansion during their removal.

Because of the more favorable permeability of shell investment molds, static pouring is much more likely to be successful than it is with solid molds. In general, shells have very good resistance to thermal shock. The various shell compositions, however, do differ in their resistance to fracture by the thermal and mechanical shock imposed during pouring of the metal. The greater the shock resistance, the more feasible designing for height in the setup becomes. The height increases the velocity and pressure of the liquid metal and thus provides the best conditions for successful static pouring.

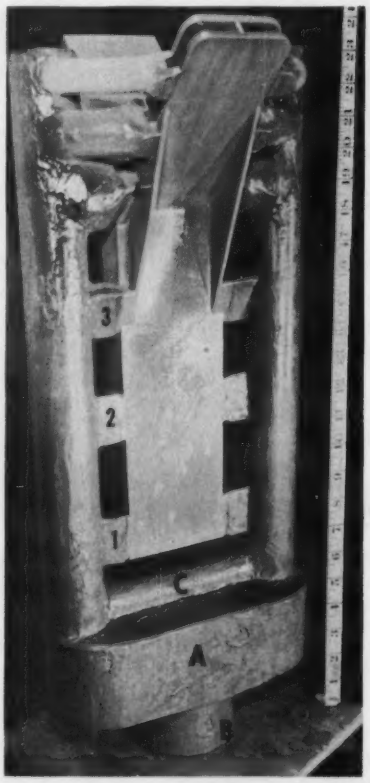

Fig. 13—This setup weighs 105 lb as cast in 4140 steel in a shell mold. Part requires 18 runners of various sizes

Shell investment molds lend themselves very well to vacuum chamber or suction assist pouring. They also may be clamped to an inversion furnace for pouring. In most instances shells are poured without back-up material for support.

The wax setup in Fig. 9 is for a shell investment mold to be poured in with suction assist. A total of 37.2 lb of 347 stainless steel will be poured to produce 32 castings like D in the illustration. Nineteen gates are required to feed the 19 heavy sections isolated by thin sections.

The pattern with 19 gate pads made integrally is shown at A. The runner at B feeds metal into the 19 gate pads. The pattern is shown at C wax-welded to the runner. The runner is $\frac{3}{8}$ in. thick where it joins the sprue and tapers to $\frac{1}{4}$ in. The $10\frac{1}{4}$-in.-high conical sprue is 2 in. in diam at the pouring basin and $1\frac{3}{4}$ in. at the lower end. The pouring basin is 4 in. in diam and 2 in. thick.

Fig. 10 shows a pattern setup of eight pieces for producing a shell investment mold to be poured with suction assist. The mold will hold 22 lb of 440C stainless steel. Pattern and gate pad A are made integrally. Runner B is put on by hand. Runner B and gate pad A are $\frac{5}{8}$ in. in diam and hold the pattern 1 in. from the sprue. The sprue is tapered from 2 in. to $1\frac{3}{4}$ in. and is $8\frac{1}{4}$ in. high.

The partial setup at top of Fig. 11 is designed to hold three patterns. Only two patterns have been mounted so that the arrangement of the runners can be seen. View A is a pattern with runners attached. Runners one, two, and three are $\frac{3}{4}$ in. in diam and connect with gates on the pattern. Runner four is $\frac{1}{2}$ in. thick, $\frac{3}{4}$ in. wide, and $1\frac{1}{8}$ in. long on the pattern side, and extends $\frac{3}{4}$ in. to the sprue. The sprue is cylindrical, 2 in. in diam and $6\frac{3}{8}$ in. high. The sprue button is 4 in. in diam and 1 in. thick. The alloy is 17-4PH stainless steel poured with vacuum assist into a shell investment mold. The cast setup weighs 20.8 lb. View B is a casting cut from the cast setup, sand blasted, and ready for the customer.

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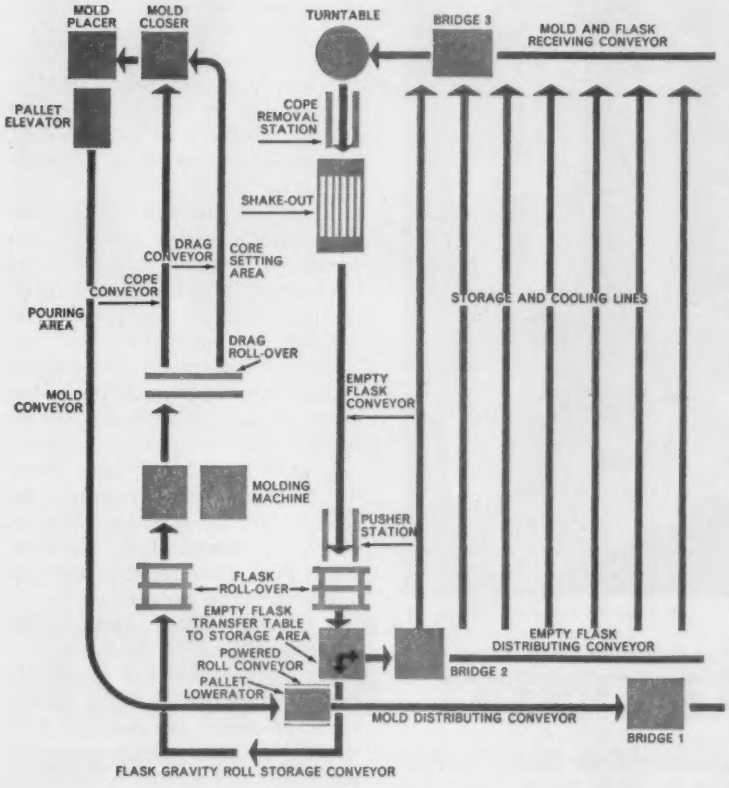

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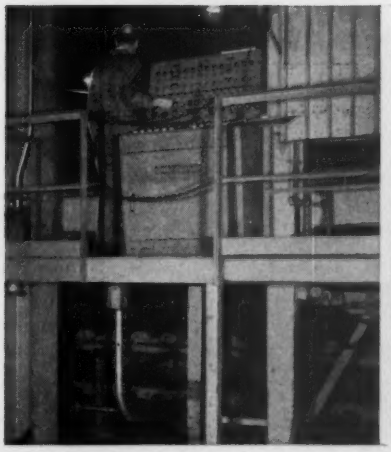
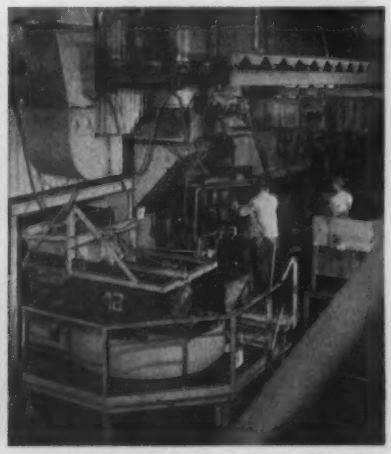


PROGRAMING From central control console, operator preprograms delivery and recovery of molds from cooling lines.

COOLING Seven lines, serviced by Link-Belt traveling bridges, store molds during cooling period.



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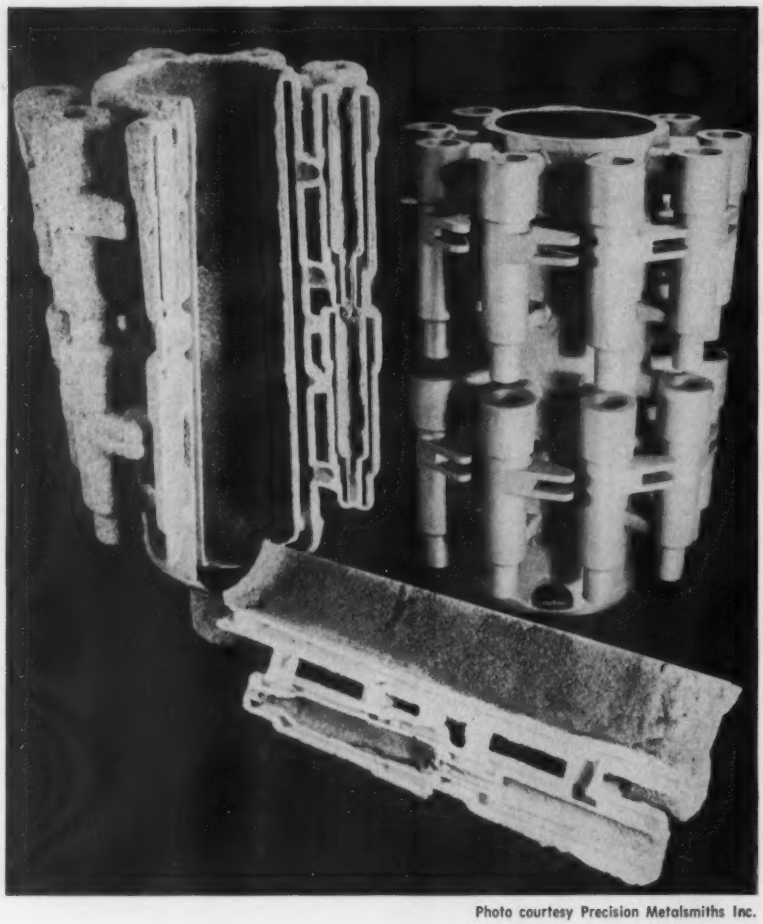

Photo courtesy Precision Metalsmiths Inc.

Fig. 14—Sectioned view shows an investment shell mold incorporating a hollow sprue. Also shown is a cast setup after removal of mold material

are cast one-in-a-mold and may be set up with a single sprue or with multiple sprues as in Fig. 12, depending mainly on configuration of the part. The setup in Fig. 12 is used to produce a shell and is gravity poured in air. The mold is poured with 27 lb of 416 stainless steel. A finished casting is shown at left; the pattern setup is at right. It required nine vertical sprues and 22 runners. The sprues are 1 in. in diam and are connected to the pattern by round or rectangular runners smaller in cross section than the sprues. The pouring basin is oval, 8¼ x 4 x 1 in.

An example of the larger size castings which can be poured in shell investment molds is given in Fig. 13. This shows the pattern setup for a 4140 low alloy steel casting. The ⅜ in.-thick shell was poured unsupported with 105 lb of metal. The part required 18 gates. Runners one, two, three, and four are ⅝ in. thick, 1½ in. wide, and extend 1 in. to the sprues. The forked runners are ¼ in. thick and 1 in. wide.

Two 18-in. sprues 2 in. in diam come off a pouring basin made in two sections. Section A is oval, 10 x 4 x 3 in. thick. Section B is 4 in. in diam and 2 in. thick. The pouring basin formed by these two sections is increased by adding section C to the setup. That section is a half-round, 1⅛ in. diam and 5¾ in. long.

Recent Developments — A new technique of gating, involving a hollow sprue, recently was developed.[8, 9] The sprue is a simple cylinder 12 to 14 in. long and from 4 to 8 in. in diam. Mean thickness of the tapered sprue wall ranges from 3/16 in. to ¾ in., depending on the alloy being cast and the size and configuration of the castings being produced. Hollow sprue pattern setups are used to make flask molds as well as ceramic shell investment molds.

The sprue may be of wax or other heat-disposable pattern material. It is attached to a pouring basin former and the assembly is mounted on a base plate. Techniques of mounting the patterns and making the molds are similar to those used for setups employing other types of sprues.

Several advantages are claimed for the new spruing technique. The ratio of castings obtained to metal poured is improved considerably. Because of the larger sprue diameter, one hollow sprue setup will produce as many castings as three or four solid sprue setups. This advantage can be realized more fully when shell investment molds are used because no flask size restrictions are imposed.

The increased mold area exposed to the heat of the oven by hollow sprue setups in shell investment molds shortens pattern melt-out and mold burn-out cycles. Metal in the mold freezes rapidly. Although fast freezing generally occurs in all ceramic shells, the freezing is even more rapid in the hollow sprue mold because absence of the massive sprue reduces the thermal gradient in the mold.

Fig. 14 shows an investment shell mold incorporating a hollow sprue. A section has been cut from the mold to show thicknesses of the mold wall and sprue. A cast setup with mold material removed is shown at right. It is of 17-4 PH stainless steel and weighs 54.4 lb. The 18 castings weigh 26.3 lb, resulting in a weight ratio of 1.07 to 1, gating system metal to cast parts.

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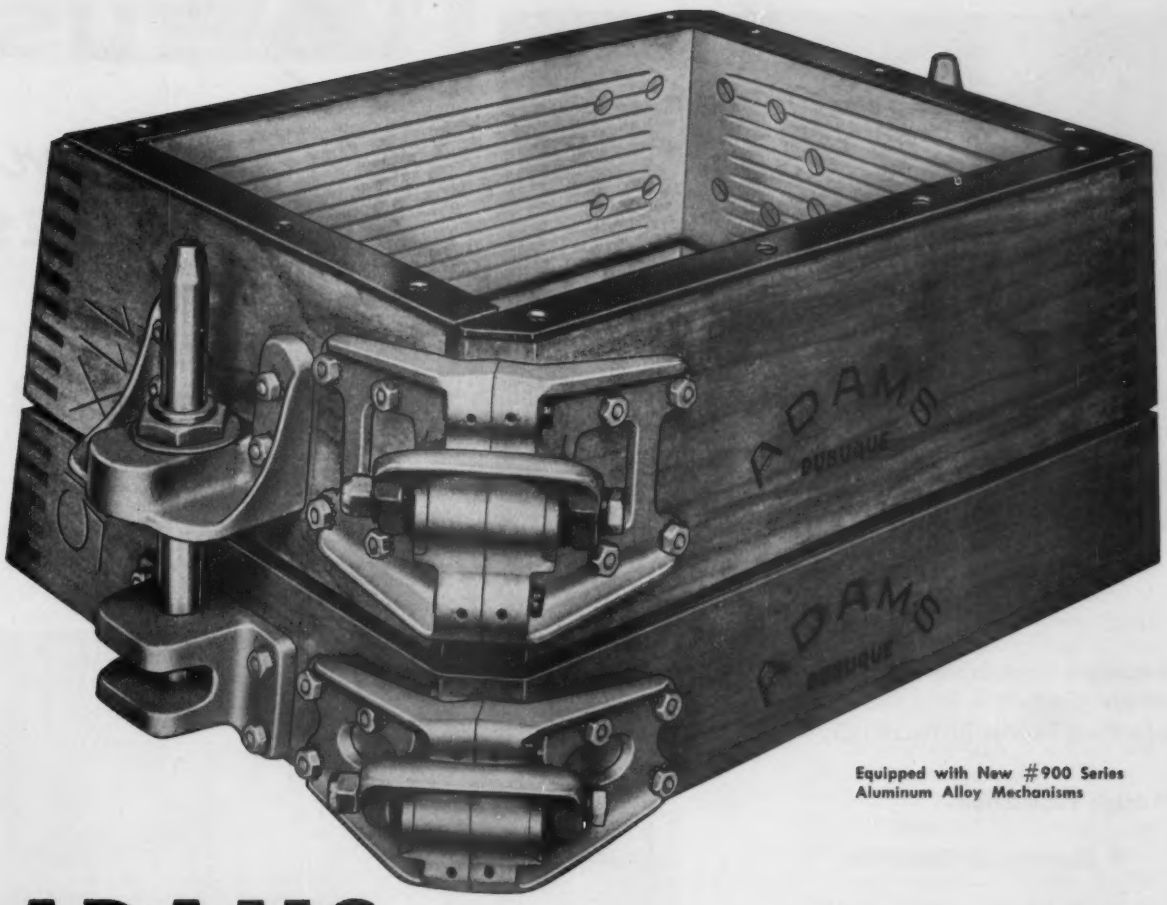

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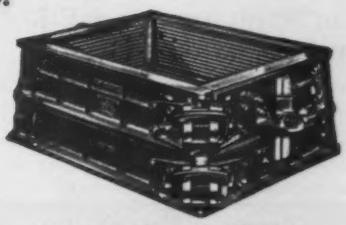

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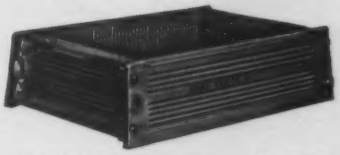

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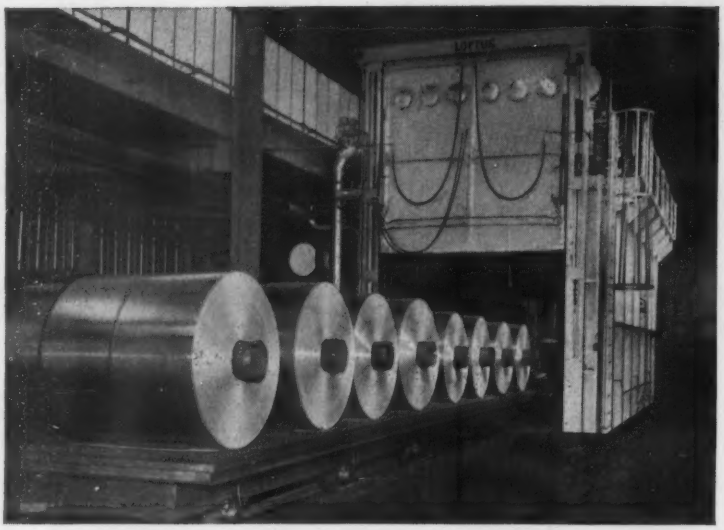

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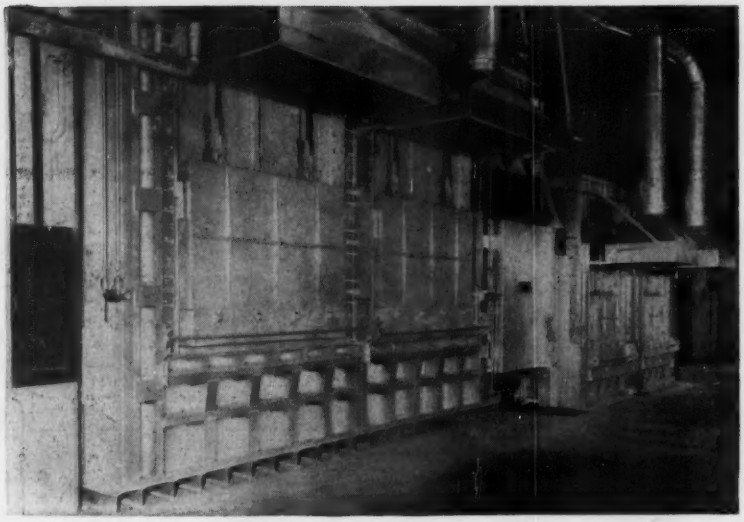

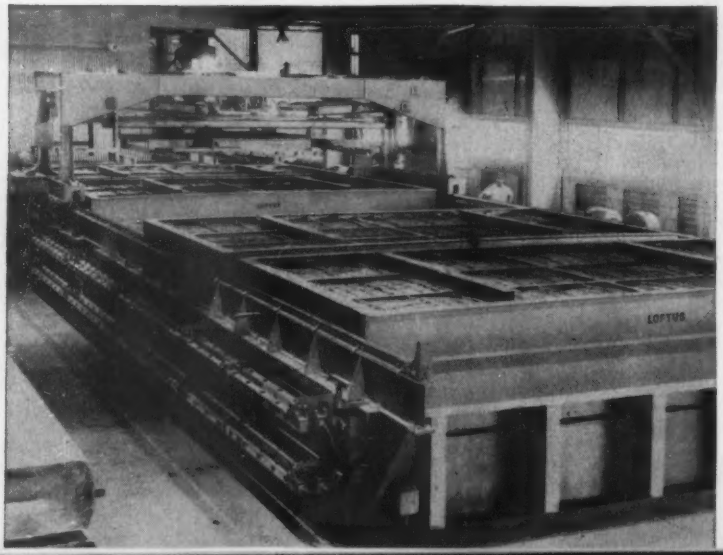

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From first heat to heat treat, look to

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For More Information Circle 680, Page 39

By RALPH L. LEE, *President*
Lee Hobby Foundry, Birmingham, Mich.

Customers in Disguise

"A check to determine how we got our customers might reveal some facts about the breeding, care, and feeding of brand new business"

● AS AN OLD RETIREE from the rather vague and mysterious business of sales promotion and sales management, I am convinced that one never can be quite sure which of his many thumps on the drum head paid off in his efforts to drum up new business.

Last week a fellow dropped in on the Lee Hobby Foundry with some castings and a wooden master pattern. He had called regarding the same job two years before and was surprised and pleased to learn that I remembered him. He also was somewhat apologetic for not having given us the job since the estimate we had given him was satisfactory.

He explained that on the first call he was shopping around. Although not happy with his foundry connection, he had been just a bit leery of gumming up his production schedule by changing horses in the middle of the stream, so to speak. But on this last visit, he confided in me, he was in such deep trouble that he didn't know which way to turn.

Man in the Middle—His customer was rejecting so many of the products he shipped that my man was losing his shirt and was likely to lose the account. He said that the foundry blamed the patternmaker and the patternmaker the foundry. The polishers and the platers blamed my caller and his customer for being so finicky. Not being a foundryman, a patternmaker, a polisher, or a plater, my caller didn't know whom to believe. He was in the middle and wondered if we would get into the situation and tell him what was what.

Resisting the temptation to appear an expert with a snappy diagnosis, I took plenty of time looking over the rejects and the pattern. I asked a lot of questions, and he kept asking, "What do you think?"

After going as far as I could, I

said, "I wish I could give you a simple answer, but your finish trouble could be caused by any number of things. There is no question in my mind that the spots on this particular piece are due to dirt."

"What do you mean, 'dirt?'" he asked.

"Loose sand caused by careless molding, poor sand conditioning, and choice of sand," I told him. I also pointed out that there wasn't much draft on the pattern at one tricky little spot. Some of the trouble could have been due to poor gating and sloppy pouring, too.

"Oh! For the love of mike," said my prospective customer.

"Now you take this piece," I went on. "See these little pinholes? I feel sure that they are caused by gas."

"Gas," he said. "What in the name of heaven has gas got to do with it?"

Melting Is Crucial—By this time he was on the verge of working himself up into a tizzy. Wishing to calm him down, I patiently explained that on a piece such as this, to which finish is all-important, great care must be taken in the melting not to get the metal too hot. "Another thing," I went on, "if the ingot is not kept dry before melting, you can get into trouble. You also must watch scrap remelt, adjustment of the heating flame, use of wet crucibles, and fluxing procedure."

"You're not giving me the runaround, are you?" he demanded. "Are you just trying to confuse me? You know darned well that I can't watch all of these things. I don't know enough about 'em."

"I'll admit," I said, "that I shouldn't have gone into all of this detail. But, just the same, I have told you the honest truth. Every single one of the items I have mentioned could be the source of the trouble you're having—besides a number of things I haven't mentioned."

"All right," he said. "So what?

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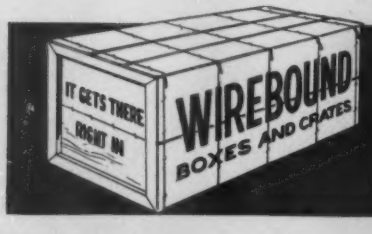

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1236

Where do we go from here?"

I suggested that he leave his pattern with us. Then we'd run a few castings and see what happened. I told him I thought we could lick the problem. Since we couldn't very well estimate just how much time it would take, we couldn't give him a price, but we had a very reasonable rate for troubleshooting work of this sort. He agreed to my proposal, and we had a customer.

Louvers Were Problem—Avoiding cores wherever possible certainly is a worthy ambition of every good pattern shop, even for an old amateur like Doc Lee. But there seems to be a no-man's land between the unavoidable use of cores and legitimate green sand molding for which nothing short of saucer, cup and spoon trickery will do. On the job in question, the pattern called for six tiny louvers to be cast in green sand with a tricky parting form. Our customer said that he never had received one casting in which all of the louvers were clear. This point was a good source of dirt. He had rigged up a punch to open the louvers.

We closed up the louvers on the pattern with a thin, punchable section, gated it with a thin, wide, carefully filleted opening in keeping with directional solidification to slow down the flow of metal into the cavity.

Again we were interested chiefly in dirt prevention. Keeping an eye on all of the possible sources of trouble which nearly had frustrated our customer, we delivered a set of samples which pleased him no end. We made a friend and got the go-ahead on production quantities.

I don't suppose that this chitchat about the goings-on in the peewee Lee Hobby Foundry can have much meat for our great big brothers in the noble craft, and certainly no moral is intended—unless it could be the observation that there's no way, at first sight, of telling a prospective customer from a person who is not.

Evidently the star of this story liked the attention he got on his first call, or he wouldn't have come back. In spite of his confusion at all the elements which enter into the making of good castings, I really believe that the strain was good for him and helped him realize that a respect for quality in a foundry can be less

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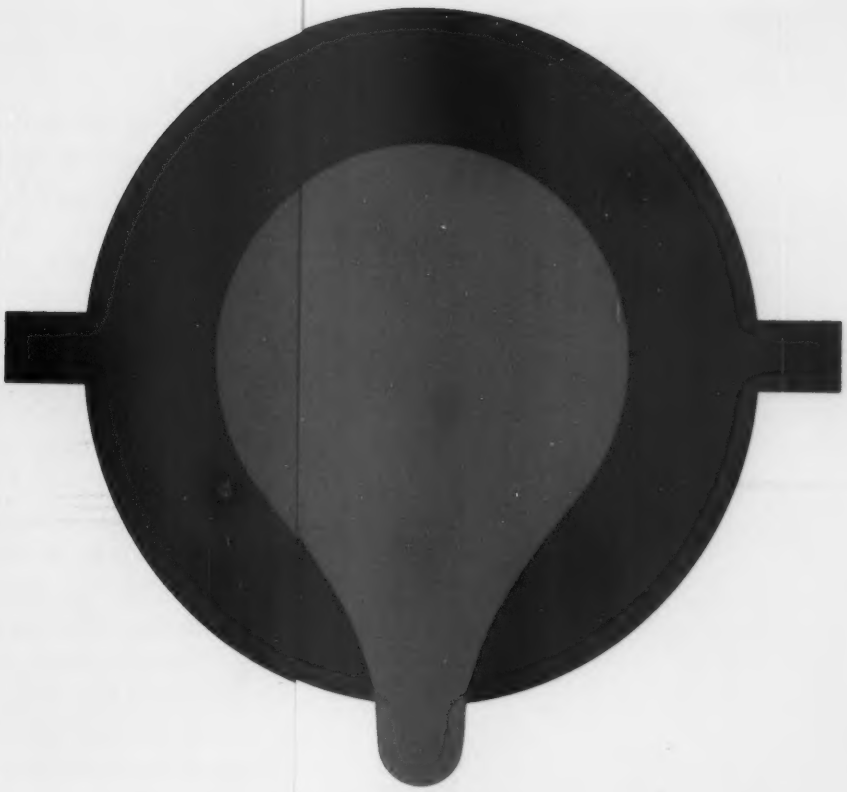
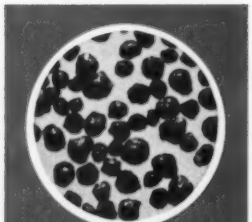


NEW MOLDING MEDIUM FOR HIGHEST QUALITY CASTINGS

TERM



UNRETOUCHED MICROPHOTO

Hard, round-grain carbon

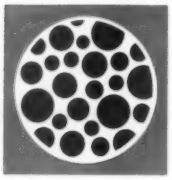
Now—after 7 years of research and d
highest quality castings. TERMCO is
4-sieve sand. It's readily moldable with
for difficult castings of non-ferrous
inert carbon, and not wettable by mol

MCO

n sand for superior cores and molds

l development—here's a practical carbon sand for your
is not crushed or pulverized. It's a hard, round-grain,
ith any conventional equipment. And especially effective
us metals, gray and malleable irons. TERMCO is solid,
nolten metal. It expands only ⅛ as much as (continued)

silica sand. As a result, there's no veining, scabbing, penetration or burn-on. Castings just naturally shake out cleaner, smoother, more accurate, precise. And TERMCO replaces zircon, olivine, and other non-silica sands at lower net cost! Be sure to try this revolutionary new molding medium soon... TERMCO carbon sand!

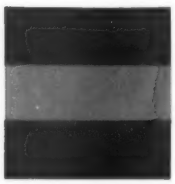


HARD, ROUNDED SHAPE. TERMCO is a patented product with a distinctive new shape (U. S. Patent Nos. 2830342, 2830913). It is derived from fluid coke, which, when calcined at 2500°F., yields a consistent 4-sieve grain distribution. TERMCO resists crushing, will not smudge, and is highly permeable. It's also readily moldable with conventional methods and equipment. For molds and facings, TERMCO can be bonded with bentonite and water. With cores, conventional binders can be used. TERMCO is applicable for oil-sand cores, shells, CO_2, cold-setting binders, etc.

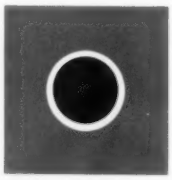
TYPICAL SCREEN ANALYSIS

Sieve No.	20	30	40	50	70	100	140	200	270	pan	
% Retained on	1.2	0.6	1.9	9.6	25.9	32.3	19.6	7.4	1.1	0.3	99.9

AFS fineness No. 73.3



HIGH CARBON CONTENT. Because TERMCO is solid, inert carbon, it is not readily wettable by molten metal, and penetration and burn-on are practically eliminated. TERMCO contains no volatile hydrocarbons. Has no sintering point. And TERMCO provides a natural reducing atmosphere in the mold, so no seacoal or other organic additives are required. Carbon's faster rate of heat transfer produces a finer, tighter grain structure on the surface of the casting. This is especially notable in bronze and aluminum.



THERMAL STABILITY. Low thermal expansion is the most outstanding and obvious characteristic of TERMCO cores and molds. TERMCO expands only $\frac{1}{8}$ as much as silica sand. There's practically no veining or scabbing. Iron oxide and cellulosic cushioning agents are not required.

ECONOMICS. TERMCO replaces zircon, olivine and other non-silica sands at far less net cost. Here's why: TERMCO has the lowest weight-per-unit-volume of any foundry sand. Weighs only $\frac{2}{5}$ as much as zircon . . . $\frac{3}{4}$ as much as silica sand. This also considerably reduces the workload of both men and machines. And TERMCO can be mixed in varying proportions with silica—in molds and cores—to realize some of the superior benefits of TERMCO at the lowest possible net cost! ■ SEND TODAY FOR MORE DETAILED INFORMATION.

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expensive than bargain prices.

Then, too, as an old sales promotion man, it occurs to me that the willingness to wrestle with the problems of a suspect and to provide a clinical service for diagnosing sick castings might be considered in the same category with other efforts to drum up new business.

But as the president of the Lee Hobby Foundry, I find that this story suggests another idea. I'm going over our list of present customers — this shouldn't take too long, either—to find out how we got them in the first place. Did they come to us? Why? Did we go after them? Were they in trouble? Did our customers recommend us? Did some one who didn't know the difference between a casting and a stamping mention that his cousin had a neighbor who knew a man who sold us coke who suggested that he knew where our plant is?

It seems to me that once these data are gathered, we might find something in common about the breeding, care, and feeding of brand-new business—and at the same time something which will help us to keep the customers we have.

Book Review

Data Sheets On Dust Collectors, **paper bound, 35 pages, 8 x 10 in., published by the British Steel Castings Research Association, East Bank Rd., Sheffield 2, England. Price 30s.**

This book is primarily a collection of data sheets on 32 dust collectors made by 19 organizations. First edition was published in 1958 for members of BSCRA. This second edition has been revised and enlarged to be useful not only to makers of steel castings, but to other foundrymen as well.

Introduction lists factors to consider in selection of dust collectors. Types of foundry dirts and units required for proper dust collection are discussed. Comments on approximate cost of dust collectors, as well as a table of efficiency curves for each type, are included.

Data sheets give information on collection efficiency, pressure drop, and water usage for each type of collector. A diagram showing the principle of operation is given in each case, as is a list of installations identified by application and capacity.

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CONTROLLING Sand Moldability and MOLD QUALITY

Fig. 1—Special scale (above) is used to weigh sand. Testing device (right) is used, also

Sand with consistent moldability will produce consistent molds under standardized ramming. For this reason controlled moldability can insure good castings

By H. W. DIETERT, *Chairman of the Board*; A. L. GRAHAM, *Research Engineer*; T. H. HANNA, *Research Technician*
Harry W. Dietert Co., Detroit

● A NEW SAND control method has been developed to improve the quality of castings by controlling the sand at a predetermined level of moldability to achieve constant mold quality.

At present, sand is controlled by attempting to hold all the ingredients, such as fines, clays, additives, and water, at a constant level. The difficulty with this method is that the molding sand in use does not remain at a constant composition. Metal-to-sand ratios, pouring temperatures, production downtime, and the sand handling process affect the burn-out of combustibles in the sand mix. Consequently, sand returning to the mixer varies in temperature and composition.

With these fluctuations in composition, the prepared sand may not ram to the desired constant mold quality even when the percentage of moisture is held constant.

Under the moldability control method, water and other ingredients are added until a predetermined moldability of the sand is secured. A sand prepared in this manner always will ram the same under standardized machine ramming, producing the same mold quality.

Mold quality is checked on a master mold with a group of portable tools which measure these mold properties: Hardness, rammability, wall creep, wall permeability, wall voids, lift, density, and penetration.

Moldability Measurement—Moldability measurement is based on the principle that ramming energy is proportional to the energy required to separate adhering groups of sand grains in the unrammed sand mix. The tougher the sand, the lower the moldability. Moldability under this concept easily is measured by determining the ability of the sand to bridge openings such as presented by a screen. When a large percentage of the sand falls through the openings, the sand has low toughness and high moldability.

Those who have riddled facing sand by hand will recall how sensitive the rate of sand passing through the screen was to the "toughness," "fatness," "heaviness," "strongness," or other old-time descriptive terms.

The new testing device shown at right in Fig. 1 is used in determining sand moldability values. A 200-gram sample of sand is placed in the screen cylinder and the screen is rotated for ten seconds.

The weight of sand passing through the screen divided by the original weight of the sample and multiplied by 100 is used as the moldability index. When the screened sand is weighed on the special scale shown at left in Fig. 1, the moldability index may be read directly.

Moldability Control—The moldability controller shown in Fig. 2 is a production control unit now in use for moldability measurement and control at the sand mixer. This device is used to regulate the water addition to the sand to secure a preselected moldability.

A small stream of sand, about 2 gal per batch, is taken from a hole in the mixer wall and carried on a vibrating screen mounted in a trough over a balance system. Sand falling through the screen is dropped on one side of an inverted-V, torsion-mounted balance; sand moving across the screen falls on the other side of the balance. The two streams of sand are weighed against each other.

At the beginning of the mixing cycle, most of the sand falls through the screen and on the near side of the balance. The balance swings to the other side, actuating valves that control the addition of water. As the sand approaches the desired moldability, less sand will fall through the screen. Water then is added at a slower rate until the balance swings substantially to the midpoint and stops the water flow. The sand mixer continues to run for a predetermined time and discharges.

Operating a sand system with ample active bonding material, i.e., a sand above 12 psi, makes for simple and effective control. With a sand of this type, the composition can vary widely, and the mold-

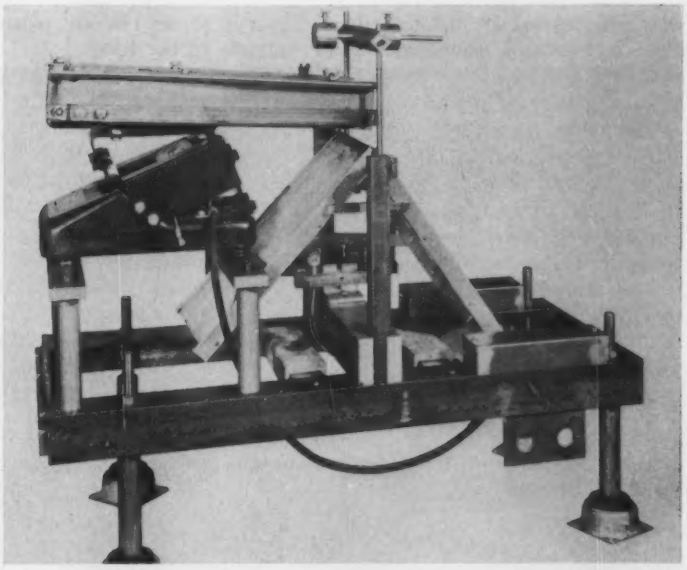


Fig. 2—Moldability controller is used for automatic control of water addition to produce consistent moldability

ability controller automatically will adjust the water to produce a good "feeling" and good ramming sand.

TABLE I—Gray Iron System Sand

Test Number	Moisture Per Cent	Moldability Index
1	4.5	87.2
2	3.9	89.3
3	4.2	90.7
4	4.1	87.5
5	4.2	85.5
6	4.1	88.6
7	3.6	88.1
8	3.7	90.9
9	3.8	88.1
10	3.8	85.6
11	3.6	90.2
12	4.2	89.3
13	4.0	90.9

Test Examples—Table I shows the variation in moisture percentage required to maintain constant moldability for a gray iron foundry system sand. The data cover an extreme case because the sand

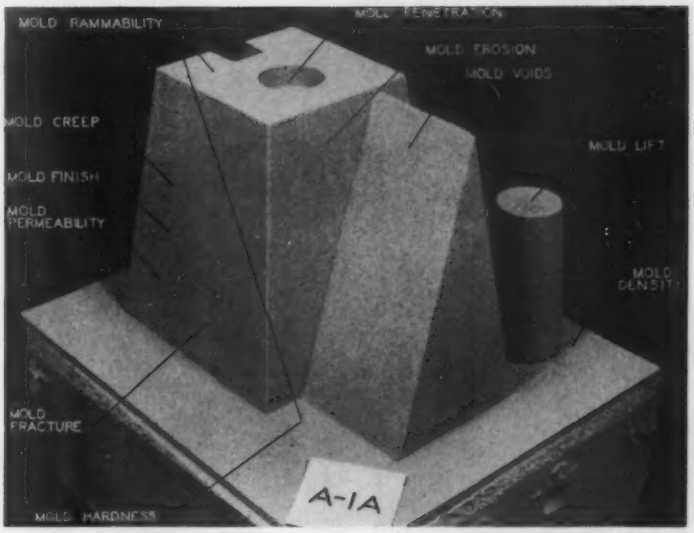


Fig. 3—Master mold pattern is used to test mold quality. Pattern is mounted on a jolt-squeeze flask-lift molding machine for making samples

Fig. 4—Mold hardness reading is taken at top of master mold for rammability determination

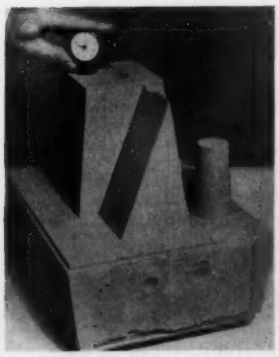
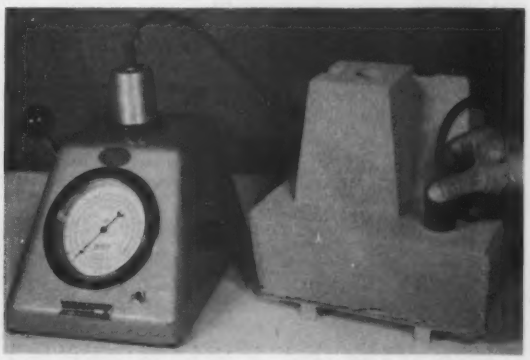


Fig. 5—Dead weight tester is used to make a creep measurement on the master mold

Fig. 6—Mold permeability may be rated by an electric permmeter with special attachment



was being cycled for the first time after a two-week shutdown, and obvious variations were noted in the appearance of the sand before conditioning.

The moldability index values were obtained with a laboratory moldability tester, and the sand samples were taken from the distribution belt after the sand had passed through an aerator. The replication is typical of aerated sands. It could be improved by a preliminary riddling through a coarse screen before placing the sample in the tester.

The best practice for routine control, however, is to test the sand as it is used by the molders. There will be a wider spread in moldability index values when the sand contains lumps, but this is a true picture of the sand.

The moldability controller will prepare sand with a nearly constant moisture content when sand entering the mill is constant in composition. Under such conditions, the moisture percentage is held within ±0.1, which is close to the reproducibility of the moisture test.

TABLE II—Automotive Gray Iron Sand

Test Number	Moisture Per Cent	Moldability Index	Moldability Index (Preriddled)
1	3.51	68.3	84.5
2	3.47	77.3	84.2
3	3.44	81.8	87.2
4	3.38	88.6	87.8
5	3.41	79.1	85.2
6	3.39	80.0	88.5
7	3.49	76.9	82.5
8	3.55	87.9	87.9
9	3.40	79.4	88.7

Table II shows the control with constant composition.

Sand temperature is not a troublesome factor in control. Sand becomes brittle as temperature rises, causing the moldability controller to add more water as sand temperature increases.

Control Levels — The desired moldability level must be established on the basis of the application for the sand. A number of factors are involved in the selection of that level.

Moldability is determined in terms of per cent by weight of sand passing through the test screen, but the results are expressed as moldability index numbers. This is done to avoid confusion because the highest moldability index number is not necessarily the best.

Actually, moldability is used here as an encompassing term, covering a number of interrelated sand properties. These properties include among others, the amount of false voids, creep deformation, and "lift" or stripping ability.

For a given pattern and molding operation, those properties of the finished mold will be affected by the moisture level of the sand. The lower the moisture level, the less the amount of false voids and the lower the creep deformation. However, enough water must be added to enable the sand to retain its shape while the pattern is removed, and to carry projections in normal handling before the pouring operation.

There is, therefore, a moldability index value that reflects the best balance between these conflicting properties, where the false voids and creep deformation are at a practical minimum value, and the sand still has sufficient stripping ability to produce satisfactory molds.

Experience has indicated that the optimum moldability index is sim-

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LOOK AT THE RECORD

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MELTING DATA

500 LB.	1000 LB.	2000 LB.
Time: 30 min.	Time: 40 min.	Time: 45 min.
Oil Used: 11½ gals.	Oil Used: 19 gals.	Oil Used: 40 gals.
*Gas Used: 1400 cu. ft.	*Gas Used: 2800 cu. ft.	*Gas Used: 5250 cu. ft.

*1030 BTU

Really hot metal . . .

of sufficient temperatures to pour light and difficult castings of excellent structure and machinability, with practically no rejects—that's the money-saving story behind the performance record of the revolutionary new U. S. "Sklenar" Reverberatory Melting Furnace. Innovations in combustion, design and construction, with patented features that contribute to faster melting, built-in economy of operation, and lower maintenance costs, are all yours in tomorrow's method of melting metals today!

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Rotoblast Steel Shot and Grit clean castings at lower cost per ton than other abrasives. That is why Rotoblast Steel Abrasives are the fastest growing on the market today. *Sales volume has tripled in 3 years.*

Low phosphorus, low sulfur steel and a special heat-treating process make Rotoblast Steel Shot and Grit solid, tough and free of voids and hollows—that's why they can save you so much on cleaning costs.

For actual figures, write to: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland; Pangborn Canada Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada;—*Manufacturers of Rotoblast® Steel Shot and Grit®; Blast Cleaning, Vibratory Finishing, Dust Control Equipment.*

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For More Information Circle 685, Page 39

Tons of Castings Cascaded like Niagara Falls

Photo Courtesy of Lancaster Malleable Castings Co. Lancaster, Pa.

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ilar for a wide range of sands. In laboratory tests using the same screen and instrument settings, the controller has produced moldable sand batches using a wide range of system sands. The moisture levels selected by the controller varied from 2.9 to 4.3 per cent for the different sands, but in each case the sands were close to the moisture content considered ideal for that sand by the individual foundry. In each case the sand produced excellent master molds.

The sands mentioned above were from high-production foundries that preferred to keep the moisture on the low side for better finish. To develop optimum moldability, enough water had to be added to coat the sand grains and additive particles, plus sufficient additional water to develop the desired properties of the clay bond.

Although the amount of water required for each sand mix varied with the surface area of the mix and the nature of the clay, the relative moldability desired was the same. Therefore, a single eight-mesh screen was suitable for a family of sands divergent in composition, but similar in end-use.

Where the sand has to be produced on the wet side to allow for evaporation due to time of exposure before the molds are closed, a lower moldability index may be necessary. This is accomplished easily by using a coarser screen or by changing the intensity of screening. The simplest method of adjustment, however, is by changing the valve openings to control the amount of overshoot at the end of the water addition.

Mold Quality—The moldability controller makes possible production of a sand that rams the same at all times. The sand will reproduce molds alike in visual appearance and in some physical properties even though considerable variations may exist in the composition and distribution of the sand. However, the mold quality, and the casting quality, still may be inferior if the basic composition of the sand mix is incorrect.

Good sand mix design is important in the moldability method of mold quality control. The moldability control system is based on the premise that with mold quality under control, precise control is ob-

For More Information Circle 686, Page 39

Circle 687, Page 39→

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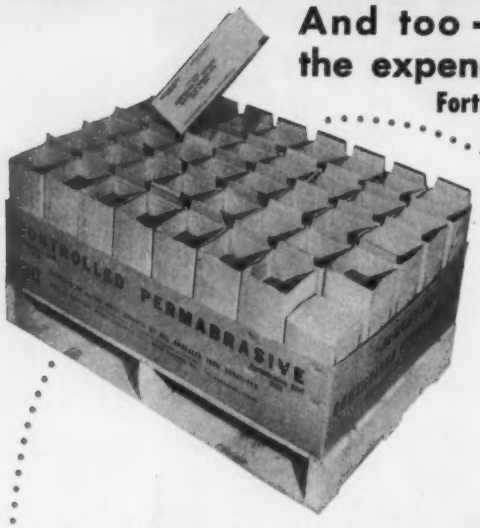

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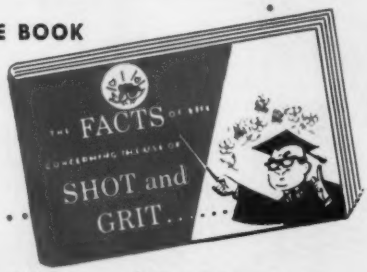

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tained over the quality of the castings produced.

A study of the quality of molds obtained from production is vital. The tools and method employed to measure mold quality will be described later. First, accept the fact that production molds do not always use the same pattern. Thus, production molds would not necessarily form a good master guide from year to year.

A master mold pattern, such as that used to prepare the mold shown in Fig. 3, is recommended as a master guide for mold quality. The pattern is mounted on a jolt-squeeze flask-lift molding machine and subjects the sand to many different forms of flow to test its moldability thoroughly.

Eight mold quality determinations, as mentioned previously, are made from this mold. In the future it is planned to use eleven determinations, as illustrated in Fig. 3, when the test equipment is completed.

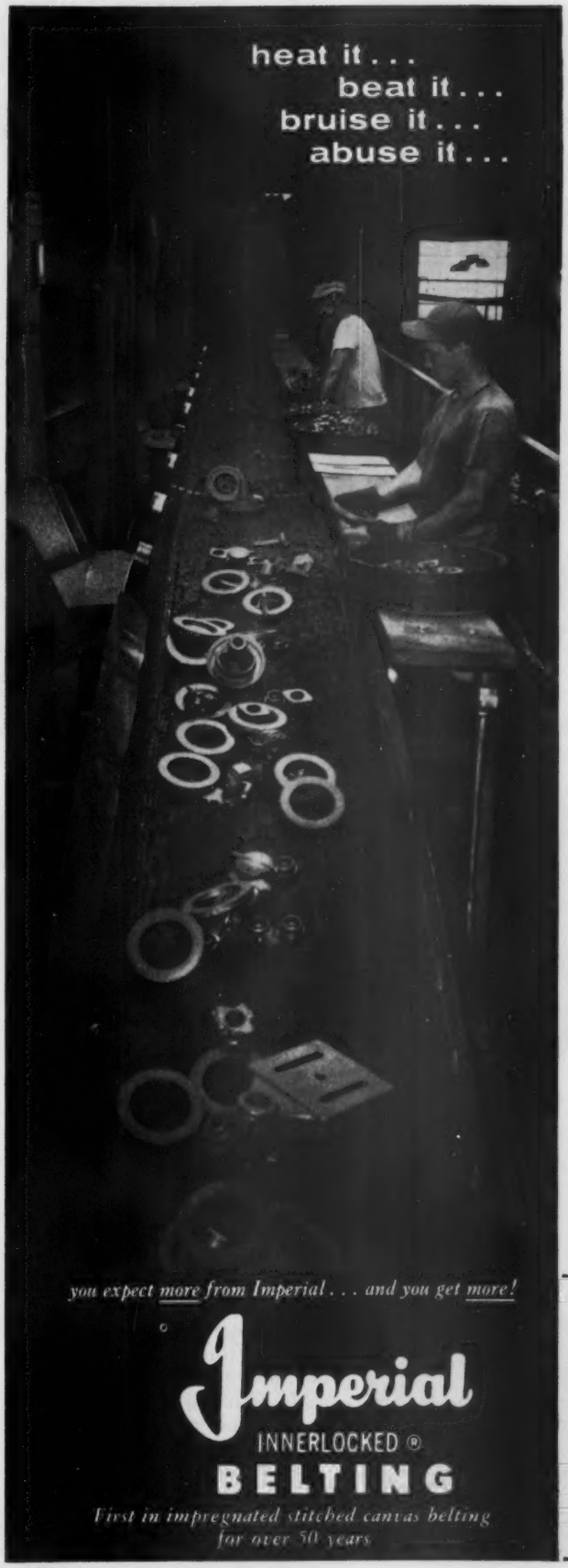
Rammability and Hardness — Mold rammability is the ability of a sand to ram to a uniform hardness along the axis of ramming energy application. Thus, a sand possesses a high degree of rammability when little differentce exists in hardness at two different depths of the mold.

Mold rammability is measured on the master mold at the two points shown in Fig. 3. The mold hardness, Fig. 4, at the top of the mold, divided by the mold hardness on the bottom, multiplied by 100 equals the mold rammability.

Rammability and mold hardness are reflected in the moldability index. With moldability control, these properties remain relatively constant despite a considerable variation in composition.

Mold Wall Creep—This property is expressed as the distance in inches that the mold wall will move in two minutes when a static load is applied. Creep is measured on the parting line using a dead weight tester, Fig. 5. Molds that show 0.003 in. or less mold wall creep will produce uniform, minimum-weight castings that are dimensionally accurate.

Mold Permeability—Venting ability and void space arrangement on the mold wall are measured in AFS permeability units. Mold perme-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(see page 318)

ability also is a function of mold hardness.

Permeability of the mold will be affected by grain size and distribution of the sand. The moldability controller will produce moldable sand even though these factors are changing, but it can not insure uniform permeability. Variation in permeability will be less, however, with moldability control than with constant moisture because the sand will ram to the same relative degree of hardness.

Mold permeability may be measured with an electric permmeter equipped with a mold permeability cap as shown in Fig. 6. The test also can be performed with a timer-equipped permeability instrument.

Mold Wall Voids—Determining extent of voids is a measurement of the magnitude of the openings under a line 0.003 in. thick. Mold wall voids are measured with an electric permmeter equipped with a mold wall voids cup which presents a 0.003-in.-thick knife edge to the mold surface. Air escapes through each void under the circular knife edge. The center of the cup is sealed with a soft rubber surface so that the mold permeability does not have a chance to function.

A mold wall voids reading taken on the plunger end of an AFS specimen rammed with 20 drops of an AFS rammer will indicate the minimum voids that a particular sand is capable of producing. Subtracting this value from the mold wall voids reading taken on a mold face gives a number representing the false voids on the mold surface as secured by the foundry manner of ramming.

Moldability control holds false voids relatively constant even though sand composition may change from hour to hour. However, the false voids should be measured on the master mold as a guide in changing the sand formulation.

Mold Lift—This property of sand is measured by the number of inches of truncated cone sand section that a particular sand is capable of lifting out of the master mold. The maximum length of cone is determined by trial.

Depth of the cone is altered by inserting discs in the cone opening of the master pattern. The thin edge of the wedge of the master

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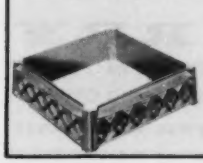

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mold also furnishes a good index of a sand's ability to reproduce fine detail and of its ability to lift.

Density and Penetration—Mold density, in pounds of sand per cubic foot, is determined by weighing the master mold and multiplying the weight in pounds by a factor obtained from a chart furnished with the master mold pattern.

Mold penetration is determined by pouring a low melting alloy of known temperature into a cylindrical depression on top of the master mold and measuring the degree of penetration on the resultant casting.

Conclusion—Use of the master mold and the tests described here, as well as the additional tests still under development, facilitate the quantitive evaluation of mold quality under controlled conditions. This has the effect of moving sand control closer to the production line for more direct benefits to foundry operation.

The usual laboratory sand tests for structural, green, air-set, and dry and hot properties still are required to determine what changes are taking place in the sand mix. These tests give information on each sand property and are necessary for proper control and formulation of the sand mix. The master mold method of control supplements the laboratory control by providing a simple, convenient procedure for studying the interplay of properties in the rammed mold.

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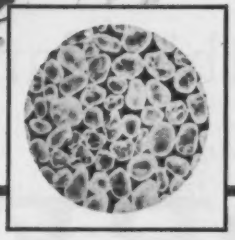

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Cerium in Ductile Iron

Bibliography entitled "Uses of Cerium (Mischmetal) in Ductile Iron Production" contains 27 recent references to application of mischmetal for the production of ductile iron.—**Cerium Metals & Alloys Div., Ronson Metals Corp.,** 45-55 Manufacturers Place, Newark 5, N. J.

For More Details Circle No. 408—Page 39

Diecasting Machine Firing

Form 6351 illustrates and describes company's forced draft gas burners for diecasting applications. It lists burner's advantages, capacities of each of three models available, and installation information. —**Iron Fireman Mfg. Co.,** 3170 W. 106th St., Cleveland 11, Ohio.

For More Details Circle No. 409—Page 39

Vacuum Furnaces

Bulletin 800 covers firm's vacuum furnaces. The booklet contains pictures and drawings of various types of furnaces available. Work spaces range from 3 in. diam by 24 in. long to 66 in. by 60 in.—**Lindberg Engineering Co.,** 2444 W. Hubbard St., Chicago 12, Ill.

For More Details Circle No. 410—Page 39

Refractories

Booklet HW-60J discusses what refractories are, sources of raw materials, quality control from blasting to batching, and how refractories research contributes to technological progress. — **Harbison-Walker Refractories Co.,** 307 Fifth Ave., Pittsburgh 22, Pa.

For More Details Circle No. 411—Page 39

Muller Mixers

Bulletin 7 describes features of line of muller mixers in sizes from 12 to 82 in. Illustrations and engineering data are included.—**International Clay Machinery of Delaware Inc.,** P. O. Box 14, Far Hills Branch, Dayton 19, Ohio.

For More Details Circle No. 412—Page 39

Gray Iron Inoculant

Brochure entitled "Inoculants for Production of High-Strength Gray Iron" includes information on purpose of inoculation, types of inoculants available, and successful use of the technique in the foundry. — **Vanadium Corporation of America,** 420 Lexington Ave., New York 17, N. Y.

For More Details Circle No. 413—Page 39

Automatic Polisher

Bulletin FS-218 describes polishers and accessories and explains the vibratory polishing technique. Samples from gold to boron carbide can be polished in sizes ranging from 0.019 in. in diameter to 2-in. metal bars.—**Fisher Scientific Co.,** 717 Forbes Ave., Pittsburgh 19, Pa.

For More Details Circle No. 414—Page 39

Tumbler Liner

Leaflet introduces lining for tumbling barrels which reduces noise, gives long life, and cuts down casting breakage.—**A. I. C. Engineering Co.,** Box 55421, Uptown Station, Indianapolis, Ind.

For More Details Circle No. 415—Page 39

Pneumatic Sand System

Pamphlet features pneumatic system for moving dry, pulverized materials such as sand from point to point in the plant, controlled either manually or automatically. Each system is engineered to specific applications.—**Brady Conveyor Corp.,** 4244 Dempster St., Skokie, Ill.

For More Details Circle No. 416—Page 39

Die Lubricating System

Bulletin No. 101 describes automatic system for spraying lubricant on diecasting dies and other uses.—**Renite Co.,** Columbus 1, Ohio.

For More Details Circle No. 417—Page 39

Lift Trucks

Catalog BU-640 illustrates and describes lift trucks in 3000, 4000, and 5000-lb capacity ranges. Catalog also includes information on engine which powers the three new units.—**Engine-Material Handling Div., Allis-Chalmers Mfg. Co.,** Milwaukee 1, Wis.

For More Details Circle No. 418—Page 39

Heat-Setting Mortars

Bulletins 29 and 36 describe Peratite, a heat-setting periclase mortar, and Kromor, a heat-setting ground chrome ore mortar. They cover use, application advantages, and physical properties.—**H. K. Porter Co., Inc., Refractories Div.,** Porter Bldg., Pittsburgh 19, Pa.

For More Details Circle No. 419—Page 39

Metal Handling Equipment

Dimensions, capacities, construction features, and lubrication data for molten metal handling equipment are contained in Catalog 60. Parts lists for all equipment also are given.—**Industrial Equipment Co.,** Minster, Ohio.

For More Details Circle No. 420—Page 39

Infrared Heaters

Principles, advantages, and typical applications of electric infrared comfort heaters are discussed in Bulletin CH-100. Electrical information, radiation distribution patterns, and charted dimensions are included in the 8-page booklet.—**Fostoria Corp.,** 1200 N. Main St., Fostoria, Ohio.

For More Details Circle No. 421—Page 39

Aluminum Alloy Selector

Selector lists each alloy by composition and shows trade, SAE, and ASTM designations; castability; machinability; thermal treatment; and properties of each.—**Wabash Smelting Inc.,** Factory St., Wabash, Ind.

For More Details Circle No. 422—Page 39

Air Compressors

Illustrated Bulletin 203 introduces four models of packaged air compressors rated at 25, 50, 75, and 100 hp. Dimensions, weights, and other specifications are listed. —**Clark Bros. Co.,** division of Dresser Industries Inc., Olean, N. Y.

For More Details Circle No. 423—Page 39

Cleaning Stars

Folder includes information on cleaning stars and other products produced from Abmet metal. Stars are claimed to cut cleaning star costs.—**Quincy Foundry Inc.,** Quincy, Ohio.

For More Details Circle No. 424—Page 39

Crowned Inflated Wheels

Sheet discusses a new development in coated abrasives which permits the user to mold resin-bonded bands to the degree

Did You Miss These?

Here is a list of popular literature items offered in recent months:

MOLD HANDLING SYSTEMS (Bulletin 135)—C. O. Bartlett & Snow Co., Cleveland 5, Ohio. Circle 402, Page 39.

SHELL CORE MACHINE—A. C. Chris Co., Chicago 20, Ill. Circle 403, Page 39.

EPOXY ADHESIVES—Furane Plastics Inc., Los Angeles 39, Calif. Circle 404, Page 39.

CORE BINDERS (Booklet D-17-14B) —Corn Products Sales Co., New York 22, N .Y. Circle 405, Page 39.

X-RAY WALL CHART (Chart M4-26)—Eastman Kodak Co., X-ray Div., Rochester 4, N. Y. Circle 406, Page 39.

INVESTMENT CASTING—WaiMet Alloys Co., division of Howe Sound Co., Dearborn, Mich. Circle 407, Page 39.

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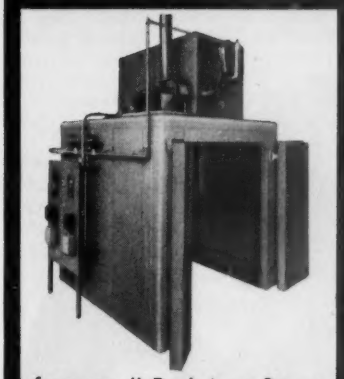

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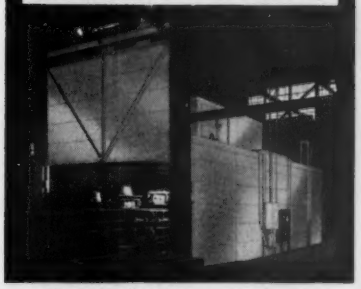

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For More Information Circle 697, Page 39

of crown desired. Operational benefits are explained.—**Nu-Matic Grinders Inc.**, Catalog Dept., 875 E. 140th St., Cleveland 10, Ohio.

For More Details Circle No. 425—Page 39

Contact Rolls

Six-page folder entitled "Contact Wheels and Rolls" discusses theory, selection, and use of contact wheels with abrasive belt setups.—**Dept. BMD, Carborundum Co.**, P. O. Box 337, Niagara Falls, N. Y.

For More Details Circle No. 426—Page 39

Drive Units

Bulletin 7100 contains 36 pages and presents information on shaft-mounted

drives, a new series of flange-mounted drives, and accessories.—**Falk Corp.**, Box 492, Milwaukee 1, Wis.

For More Details Circle No. 427—Page 39

Anti-Piping Compound

Brochure explains advantages and applications of Feedex, a moldable exothermic anti-piping compound. Technical information, photographs, and information on the six grades available are included.—**Foseco Inc.**, P. O. Box 8728, Cleveland 35, Ohio.

For More Details Circle No. 428—Page 39

Induction Heating and Melting

Bulletin 1260 supplies information on low and high frequency melting, induction billet heaters, frequency converters and accessories, and vacuum melting and degassing. — **Ajax Magnethermic Corp.**, Youngstown 1, Ohio.

For More Details Circle No. 429—Page 39

Thermocouples

Catalog presents engineering data and prices for thermocouples and pressure probes.—**Advanced Dynamics Inc.**, 16321 Rockside Rd., Cleveland 37, Ohio.

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Blast Cleaning Barrels

Five heavy-duty barrels, with work capacities ranging from 15 to 102 cu ft, are described in Bulletin No. 705. Illus-

* BAD BRONZE CASTINGS

Every Bronze Foundryman produces a bad casting now and then (sometimes all too frequently). Some of these defects are due to the design of the casting, and some to the plain old "human element." Weldability can often remedy errors of the latter and save the bronze castings from the scrap pile.

As to those lost because of their intricate design, by incorporating this weldability, the part may be cast in less intricate shapes and welded together. 90-10 Cupro Nickel, in addition to its ability to be repair welded, and thus reduce the scrap pile, is an alloy with excellent corrosion resistance and tensile properties between 45,000 and 95,000 PSI. Moreover, it can be put together from virgin materials at costs close to M&G Metal.

Need more information on this, or on any of the more than a hundred other foundry alloys handled by Whitehead? Let me know, and we can talk some more.

Casting Comments by other Whitehead Foundry Specialists appear elsewhere in this issue. Look for them.

WHITEHEAD METALS, INC.
303 West 10th St., New York 14, N.Y.

CASTING * COMMENTS

by JOHN WHELAN
Whitehead Foundry Specialist

For More Information Circle 698, Page 39

Operation: Blast Cleaning

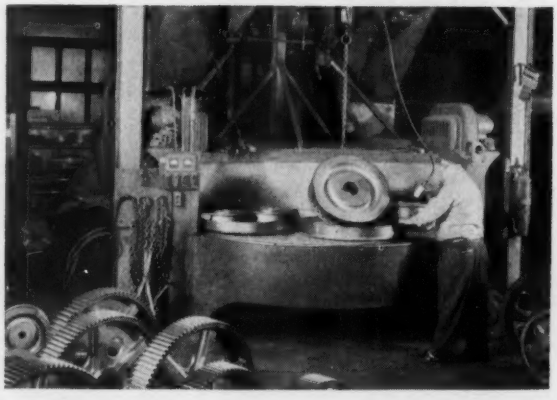
(one of a series)

THIS CASTING TOOK 15 MINUTES TO CLEAN . . .

THIS ONE ONLY 4 MINUTES WITH ROTOBLAST

No two ways about it: Rotoblast equipment cuts cleaning costs, sometimes by as much as 70%. Hundreds of manufacturers have improved their profit picture — as well as their quality of cleaning — with Rotoblast because it reduces manpower—up to 75% . . . works faster, up to 50% faster for straight through processing ...requires much less maintenance... reduces down-time.

Whether it is a small Rotoblast barrel or a giant tableroom, you'll find that the day you start using Rotoblast is the day your cleaning costs start to come down. And you'll get additional cleaning economies with the use of solid, tough, Rotoblast Steel Shot and Grit. To get the full story, write:



Pangborn

OF HAGERSTOWN

PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada;—Manufacturers of Blast Cleaning, Vibratory Finishing, Dust Control Equipment—Rotoblast® Steel Shot and Grit®.

UNIVERSAL

REFRACTORY GATING COMPONENTS

• The *Thinwal* construction, providing as much as *35% lighter weight* will not spall nor erode in use even at temperatures up to 3250°F. They eliminate slag inclusions, stop rejects, reduce cleaning room time.

Standards and specifications bulletin available on request. Units for special applications quoted.

UNIVERSAL CLAY PRODUCTS CO.

1515 First St. • Main 6-4912 • Sandusky, Ohio

P. O. Box 3215

For More Information Circle 700, Page 39

trated case histories and specifications are included.—**Pangborn Corp.**, Hagerstown, Md.

For More Details Circle No. 431—Page 39

Aluminum Alloy Fluxes

Booklet contains detailed instructions on methods of use of five types of fluxes which aid in reduction of casting rejects. Photographs show comparisons of fluxed and unfluxed castings.—**Apex Smelting Co.**, 2537 West Taylor St., Chicago 12, Ill.

For More Details Circle No. 432—Page 39

Mechanical Handling Devices

Automatic mechanical handling devices are described and illustrated in a four-page brochure. Units are for use with overhead cranes and can be engineered for a variety of uses.—**American Forge & Manufacturing Co.**, 818 Shore Ave., Pittsburgh 12, Pa.

For More Details Circle No. 433—Page 39

Industrial Brakes

Bulletins CE-410 and CE-420 feature information on DC Series 600 and AC Series 200 industrial brakes. Standard crane hand signal chart with decals for placement in crane cabs also is included.—**Ederer Engineering Co.**, 2931 First Ave., South Seattle 4, Wash.

For More Details Circle No. 434—Page 39

Refractory Insulation

Physical properties, thermal conductivity data, and qualities of refractory insulation materials are contained in technical folder. Products described provide high thermal efficiency and mechanical strength from room temperatures to 1900° F.—**Kaiser Refractories & Chemicals Div., Kaiser Aluminum & Chemical Sales, Inc.**, Kaiser Center, 300 Lakeside Drive, Oakland 12, Calif.

For More Details Circle No. 435—Page 39

Plant Safety

Supplemental Bulletin 22 tells of safety systems developed for plants using gas. Included on the sheet are descriptions of the system's safety shutoff valves and supervising gas cocks.—**North American Mfg. Co.**, 4455 E. 71st St., Cleveland 5, Ohio.

For More Details Circle No. 436—Page 39

Sand Blaster

Leaflet 602 features portable sand blasting unit for abrasive cleaning.—**ALC Co.**, Box 40, Medina, Ohio.

For More Details Circle No. 437—Page 39

Sand Mold Gaskets

Technical bulletin describes nature, application, and advantages of company's sand mold gaskets.—**Thiem Products Inc.**, Milwaukee 19, Wis.

For More Details Circle No. 438—Page 39

Metallurgical Sample Grinders

Issue No. 5, Vol. VI, of company publication, *Metal Digest*, features equipment used in coarse grinding of metallurgical

* "JUGGLING" FOR HIGHER TENSILE CAST IRONS

Did you know that 2 base irons can produce selected tensile strengths from 30,000 to 60,000 PSI just by the proper "juggling" of small amounts of alloying elements.

Take a look at these figures:

3.25% T.C.-2.25% Si Iron has a tensile strength of 30,000 PSI. Adding only 0.75% Ni and 0.30% Cr increases the tensile strength to 35,000. 1.50% Ni-0.60% Cr to 40,000; 1.50% Ni, 0.30% Cr, 0.30% Mo to 45,000; 2.00% Ni, 0.60% Mo to 50,000.

Similarly, the tensile strength of 3.00% T.C. – 2.00% Si Iron zooms from 35,000 to 60,000 PSI with properly selected alloys and quantities.

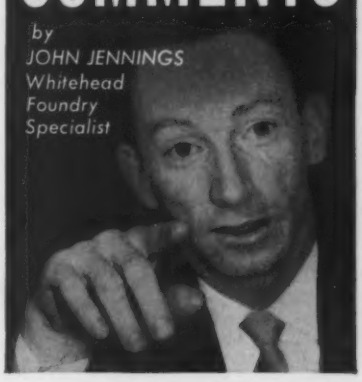
And, higher tensiles are just part of the benefits, you also get greater wear resistance, uniform hardness throughout light and heavy sections, better corrosion resistance and improved resistance to thermal shock and general heat effects.

Let me know if you would like to discuss this alloying procedure further.

Casting Comments by other Whitehead Foundry Specialists appear elsewhere in this issue. Look for them.

WHITEHEAD METALS, INC.
303 West 10th St., New York 14, N.Y.

CASTING * COMMENTS



For More Information Circle 701, Page 39

3 good reasons why foundry applications depend on quality HOEGANAES products

Reason No. 1

is **HOEGANAES ANCOR FLAME POWDER**

. . . which speeds torch cutting and scarfing of oxidation resistant materials, stainless steels, and even heavy gray iron castings.

Reason No. 2

is the new **HOEGANAES GRADE "A" BRIQUETTES for melting stock**

. . . which are of improved high density and purity. For use in induction and arc furnaces, producing corrosion resistant steel alloys.

Reason No. 3

is **HOEGANAES MELTIRON SHOT for melting stock**

. . . and soon to be introduced on the market. A melting stock low in phosphorous, sulphur and cobalt. HSIC Meltiron has been proven commercially in test quantities to produce high grade stainless and high alloy steels.

Your inquiry on these HSIC products will bring prompt response with literature and product data. Or perhaps you would like the services of a field engineering representative. He's at your service.

HSIC

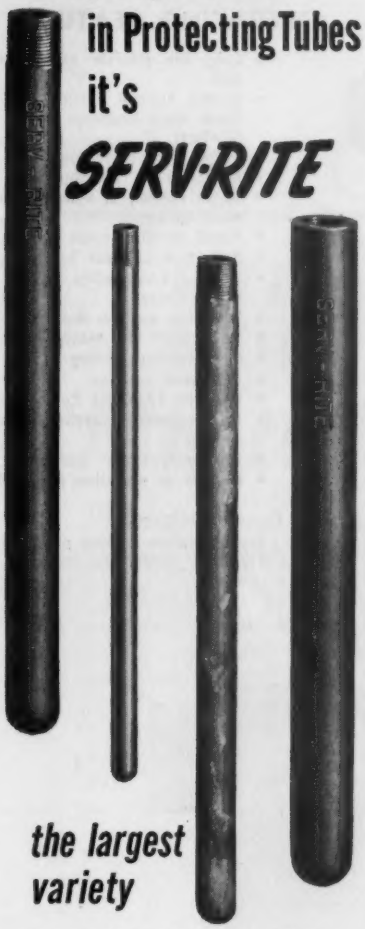
HOEGANAES

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fosteria), Edmonton (Alberta, Canada), Montreal (Canada), Toronto (Canada), Los Angeles, Mexico 16, D. F. (Mexico), Minneapolis, New England (Elmira, N. Y.), Odessa (Texas), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

for any requirement in Protecting Tubes it's SERV-RITE



the largest variety

In size and length, in iron, nickel, and alloys, and in formed or precision drilled, Gordon has about the largest variety of thermocouple protecting tubes. And you get off-the-shelf delivery on most any of this great variety of "standard" tubes. Gordon also makes protecting tubes to specifications for special requirements.

Give Serv-Rite a trial on your next protecting tube requirements. You can't go wrong. Careful manufacture and rigid inspections assure satisfaction. Get full information today. Ask for Bulletin 11-13.

● **Bulletin 11-13 gives general application data, specifications, and ordering information on Serv-Rite protecting tubes and protecting wells—the largest grouping in one listing.** 6221

CLAUD S. GORDON CO.
Manufacturers • Engineers • Distributors

607 West 30th Street, Chicago 16, Ill.
2027 Hamilton Ave., Cleveland 14, Ohio

For More Information Circle 703, Page 39

samples. Included are illustrations, descriptions, and prices.—Buehler Ltd., 2120 Greenwood St., Evanston, Ill.

For More Details Circle No. 439—Page 39

Conveyor Belting

"How To Specify, Install, and Care for Conveyor Belting" is a 24-page reprint of articles from FOUNDRY. Booklet presents some of the facts which must be considered in selection, installation, and maintenance of belt conveyors.—Reader Service, FOUNDRY, Penton Bldg., 1213 W. Third St., Cleveland 13, Ohio.

For More Details Circle No. 440—Page 39

Carbide Saws

Twenty-page catalog describes carbide-tipped saw blades and tools for working with wood, plastic, and nonferrous metals.

Accessories are featured, also.—Victory Carbide Saw & Tool Co., 1021 Anita Ave., Antioch, Ill.

For More Details Circle No. 441—Page 39

Nonferrous Casting Quality

Control of shrinkage problems is featured in the *Asarco Non-Ferrous Metals Digest*, Vol. 2, No. 2. An article on the importance of high purity zinc to zinc diecast products is included.—American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.

For More Details Circle No. 442—Page 39

Cranes

Brochure provides information on heavy-duty industrial cranes, ranging from 20 to 75-ton capacity and 78 to 150-ft span. Literature includes list of basic magnetic motor control requirements.—Milwaukee Crane Div., Novo Industrial Corp., Cudahy, Wis.

For More Details Circle No. 443—Page 39

Die Lubricating Systems

Leaflets describe and illustrate company's automatic die lubricating system for zinc, aluminum, and magnesium die-casting.—Calco, 2700 E. Main St., Columbus 9, Ohio.

For More Details Circle No. 444—Page 39

Vibrators

Four-page folder entitled "Big Shake Bulletin 1043" describes air, electric, gasoline, and hydraulic-powered vibrators for

IMPROVEMENTS IN INOCULANTS

For years, gray iron foundrymen have known the use of proper inoculants provide certain benefits. And, just as foundry techniques have improved through the years, so has the performance of inoculants.

Primarily, you would have used an inoculant to reduce chill efficiently in thin sections and edges, or possibly just to improve grain structure or machineability.

The latest step in the history of improving inoculants is Thermosil by Vancoram.

Because of its exothermic characteristics, Thermosil can be added without loss of temperature. For example, it has been added to 50 lb. hand ladles without encountering any loss of effectiveness or slag inclusions. We have also experienced a smaller, well-distributed graphite flake structure along with less primary ferrite structures. This in turn suggests higherstrength, greater wear resistance and uniform Brinell Hardness readings.

Finally, Thermosil's low-price means further savings to you.

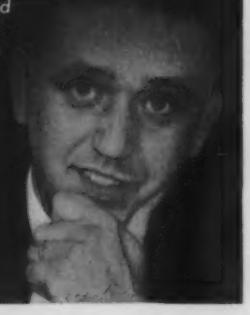
Call me if you'd like more information on this interesting product.

Casting Comments by other Whitehead Foundry Specialists appear elsewhere in this issue. Look for them.

WHITEHEAD METALS, INC.
303 West 10th St., New York 14, N.Y.

CASTING COMMENTS

by
FRANK NORWICH
Whitehead
Foundry
Specialist



For More Information Circle 704, Page 39

OPERATING FEATURES

- Long life flexible compensating pad
- Simple control setting for uniform mold hardness up to 100 (Dietert)
- In-line flask indexing
- Minimum air consumption
- Sprue formed in machine during molding cycle
- Rapid molding cycle
- Reduction of flask barring
- Pattern accessibility—quick pattern change
- Precision pattern draw
- Upset built into machine
- Metered flask filling
- Low sand spillage
- Unitized TACCONE Power-Pac
- All indexing movements cushioned
- Plug-in type limit switches
- No jolt or vibration required

Representative casting produced on TACCONE Hi-Density Molding Machines

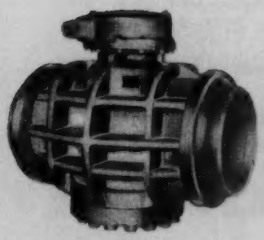
TACCONE

HYDRA-PNEUMATIC MOLDING MACHINE

"Meets The Challenge"

"Dimensional Stability" Permits Thin Wall Castings from Precision Green Sand Molds

The TACCONE HYDRA-PNEUMATIC MOLDING MACHINE has solved the problems of uniform high density molding with green sand using an extremely wide range of sand mixes—green mold hardness of 100 if desired. Uniform density over entire mold surface, right up to the flask edges. No soft spots—the TACCONE Hydra-Pneumatic Principle tends to make the sand act as a fluid by transmitting equal pressure in all directions. The only contact with the sand during the molding cycle is a flexible abrasion resistant compensating pad. Opens the field for high production green sand molds for precision thin wall ferrous castings, as well as non-ferrous castings. Assures the ferrous green sand casting business more prominence in the cast metal industry.

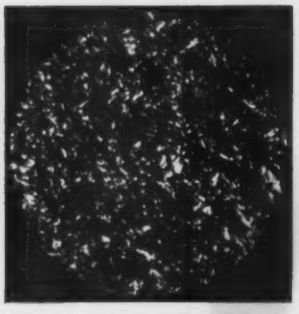


TACCONE'S Modern Manufacture Facility for the Production of Molding Machines and Foundry Equipment. Demonstrations Invited.

TACCONE
CORPORATION
NORTH EAST • PA.

For More Information Circle 705, Page 39

Wheelabrator steel shot® cleans faster because it's harder



Microstructure of Wheelabrator Steel Shot. Magnification is 500 diameters. 2% Nital etch.

A demonstration of WHEELABRATOR'S

VITAL VALUES

The harder the abrasive, the faster it cleans. And Wheelabrator Steel Shot is hard—6 to 10 Rockwell points harder than any other steel abrasive. In addition, it is heat treated to give maximum toughness and longest fatigue life consistent with its uniform high hardness. Thus, you receive the Vital Value of extra savings through reduced abrasive consumption, plus faster cleaning speed because of the higher hardness. Wheelabrator experience in pioneering airless blast cleaning progress always has meant greater savings for you. For the full story of the Vital Values and savings built into Wheelabrator steel abrasives, write for Bulletin 903-D.

VITAL VALUES FOR INDUSTRY

WHEELABRATOR STEEL ABRASIVES

WHEELABRATOR CORPORATION, 505 S. Byrkit St., Mishawaka, Ind.
In Canada, WHEELABRATOR CORP. of Canada, Ltd., P.O. Box 490, Scarborough, Ont.

a wide variety of applications. Action photos, drawings, engineering data, and prices are included.—Martin Engineering Co., Neponset, Ill.

For More Details Circle No. 445—Page 39

Box Furnaces

Bulletins C-15-A and 1046A discuss design and application of soft metal and high-temperature box furnaces. Sheets include specification tables for various models. — Hevi-Duty Electric Co., Milwaukee 1, Wis.

For More Details Circle No. 446—Page 39

Graphite Products

Winter issue of quarterly magazine, *Design & Application Technics*, offers information on application engineering applied to powder metallurgy parts and on several graphite products and applications. —United States Graphite Co., division of Wickes Corp., Saginaw, Mich.

For More Details Circle No. 447—Page 39

Welding Products

List 11160/N catalogs welding rods, fluxes, welding equipment, and accessories, including two new rods, and illustrates latest additions to company's wide range of products.—Suffolk Iron Foundry (1920) Ltd., Stowmarket, Suffolk, England.

For More Details Circle No. 448—Page 39

Anti-Skid Abrasive Cement

Fact sheet discusses uses of Carbo Resin-Rubber Cement RR6 and gives application instructions for anti-skid treatment of asphalt and concrete surfaces. It includes a picture and caption application story.—Carborundum Co., P. O. Box 337, Niagara Falls, N. Y.

For More Details Circle No. 449—Page 39

Crane Components

Catalog 61-A offers illustrated descriptions of hoist and crane components. Booklet includes information on trolleys, runway rails, hanger fittings, and other components for 1 to 15-ton capacity cranes.—Consolidated Crane & Engineering Corp., P. O. Box 3093, Terminal Annex, Los Angeles 54, Calif.

For More Details Circle No. 450—Page 39

Rotary Tools

Portable air-powered grinders and buffers in 4 to 8-in. sizes plus accessories are featured in six-page Bulletin SG.—Rotor Tool Co., 26300 Lakeland Blvd., Cleveland, Ohio.

For More Details Circle No. 451—Page 39

Die Temperature Controller

Folder describes automatic die temperature control unit, its advantages, and its operating principles. — Industrial Mfg. Corp., 31 E. Georgia St., Indianapolis 4, Ind.

For More Details Circle No. 452—Page 39

Electric Motors

Bulletin 05-51B9040B describes and illustrates Super-Seal motors with Poxeal

Ask HEVI-DUTY

Sandusky Foundry and Machine Company did...

and now heat treats centrifugal castings of carbon and alloy steel at controlled, uniform temperatures up to 2050° F. with a

Sandusky Foundry and Machine Co. selected this Hevi-Duty Electric Car Bottom Furnace, rated at 2050° F. for their heat treating requirements. Casting being heat treated here weighs 13,700 lbs.

HEVI-DUTY CAR BOTTOM FURNACE

When your heat treating applications demand *quality production at uniform controlled temperatures*, Hevi-Duty can supply either electric or fuel-fired furnaces to meet your requirements.

For example: At Sandusky Foundry and Machine Co., Sandusky, Ohio, centrifugal steel castings up to 50 inches in diameter by 33 feet in length have been heat treated in a Hevi-Duty Electric Car Bottom Furnace. This furnace provides accurately controlled temperatures to 2050° F. in its 6′ x 6′ x 34′ long chamber. They use it to normalize, temper and anneal steel and stainless steel castings. Parts are either air cooled or water quenched.

The Hevi-Duty Car Bottom Furnace features five zones of temperature control, and by placing a dividing wall between the three forward and two rear zones, two separate loads with different temperature ranges can be treated simultaneously. Heating elements in side and end walls, ceiling, door and car bottom, plus three removable air-circulating fans help provide uniformity of temperature.

Whatever your particular heat treating application, there's a Hevi-Duty furnace designed to do the job. Car Bottom Furnaces are available with many arrangements and optional features—single or double end, retort type, controlled atmosphere, forced-air convection and others. Be sure to contact Hevi-Duty first for your heat processing equipment needs.

HEVI-DUTY

A DIVISION OF BPC BASIC PRODUCTS CORPORATION

ASK HEVI-DUTY for more information on electric or fuel-fired heat treating furnaces. Car Bottom Furnaces are fully described in Bulletin 644R.

HEVI-DUTY ELECTRIC COMPANY, MILWAUKEE 1, WISCONSIN

Industrial Furnaces and Ovens, Electric and Fuel • Laboratory Furnaces • Dry Type Transformers • Constant Current Regulators

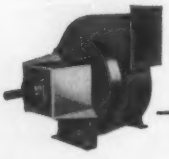
For More Information Circle 707, Page 39

Of course, not every industrial process requires fans that will operate in temperatures up to 2000° F. But when they do . . .

. . . *no job is too hot to handle for a Thermal-Aire Fan!* High temperatures, corrosive atmospheres, dust-laden or gaseous environments . . . whatever the condition, you can rely on Thermal-Aire Fans for smooth, dependable performance because . . .

. . . *every Thermal-Aire component is designed for the job!* A good example is Garden City's exclusive Air-Cooled Shaft. Without water cooling, heat slingers or other cooling systems, this unit disperses heat quickly, efficiently. Keeps bearings cool. Prolongs fan life. The Air-Cooled Shaft is typical of the engineering skill and manufacturing quality built into Garden City Fans for more than 80 years.

For a smooth operator on *your* hot jobs, be sure you specify Thermal-Aire Fans! Write today for Bulletin 960. *Garden City Fan & Blower Co.,* 837 *North Eighth Street, Niles, Michigan.*



Thermal·aire Fans®

and Silco-Flex insulations. It shows why these motors are being put into service under severe operating conditions and lists advantages of the full-protection features.—**Allis-Chalmers Mfg. Co.,** Milwaukee 1, Wis.

For More Details Circle No. 453—Page 39

Sonic Diecasting

Folder describes Vibrocast process, which uses sound waves to remove gas from castings and is claimed to increase tensile strength of diecast products.—**Southern Die Casting & Engineering,** 206 Albertson Rd., High Point, N. C.

For More Details Circle No. 454—Page 39

Air Gaging

Air gaging principles and applications and equipment available for these functions are covered in Catalog 615. A section is devoted to air capsules, special features, and wide-tolerance gaging.—**Taft-Peirce,** Woonsocket, R. I.

For More Details Circle No. 455—Page 39

Fluid Power Equipment

Capacities and specifications of pumps, motors, transmissions, cylinders, and valves for fluid power equipment are listed in bulletin 10051-H. Variety of models is illustrated in the 16-page brochure.—**Oilgear Co.,** Milwaukee 4, Wis.

For More Details Circle No. 456—Page 39

Holdback Clutches

Catalog explains operation of holdback clutches with torque capacities from 1200 to 136,500 ft-lb. Supplementary information includes tabulated data on 12 available models in bore sizes 1 15/16 to 12 in.—**Formsprag Co.,** 23601 Hoover Rd., Warren, Mich.

For More Details Circle No. 457—Page 39

Refractories

Twelve-page brochure describes line of refractories for use in cupolas, electric furnaces, air furnaces, metal handling equipment, special melting equipment, and heat treating furnaces. Investment molding products also are featured.—**A. P. Green Fire Brick Co.,** Mexico, Mo.

For More Details Circle No. 458—Page 39

Overhead Cranes

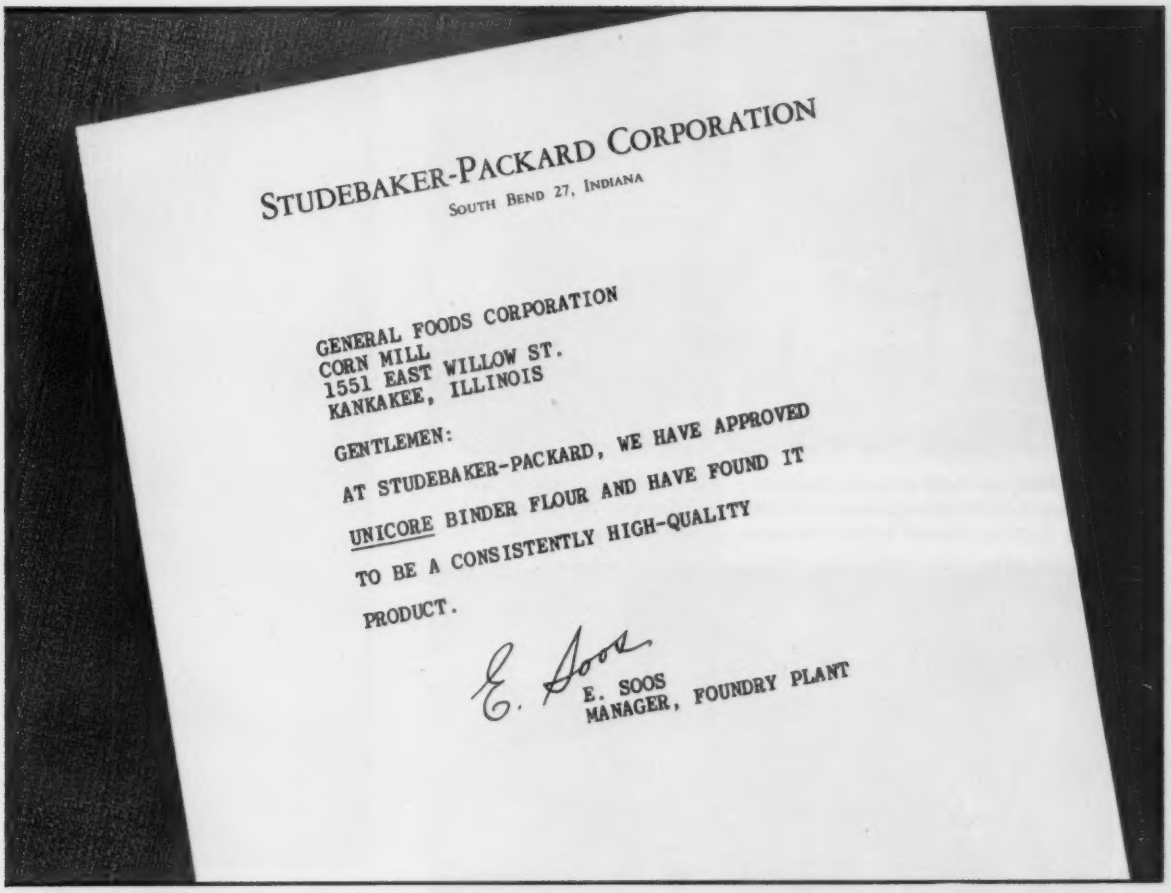
Bulletin 6-B describes features of three models of overhead cranes in various sizes. Dimensions, capacities, and scale drawings are presented with brief descriptions of several jib cranes.—**Abell-Howe Co.,** 7747 Van Buren St., Forest Park, Ill.

For More Details Circle No. 459—Page 39

Barrel Finishing

Booklet of 96 pages is entitled "Barrel Finishing" and contains working information on all phases of barrel finishing of parts such as diecastings and small sand castings. Data are included on applications, materials, and equipment.—**Norton Co.,** Worcester 6, Mass.

For More Details Circle No. 460—Page 39

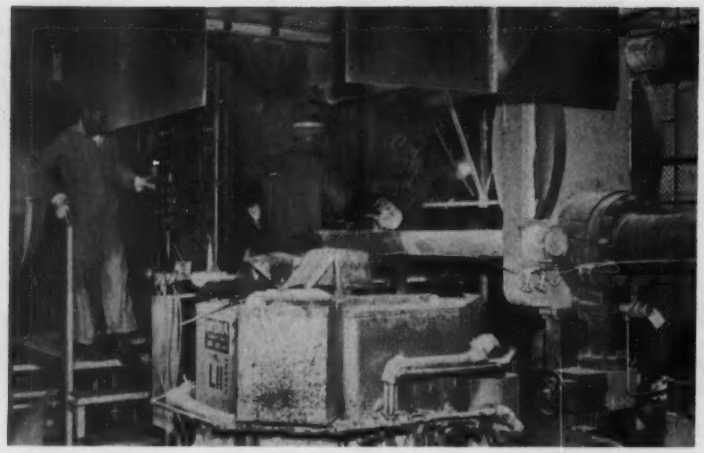


For those not yet acquainted with UNICORE, General Foods repeats its introductory pledge:

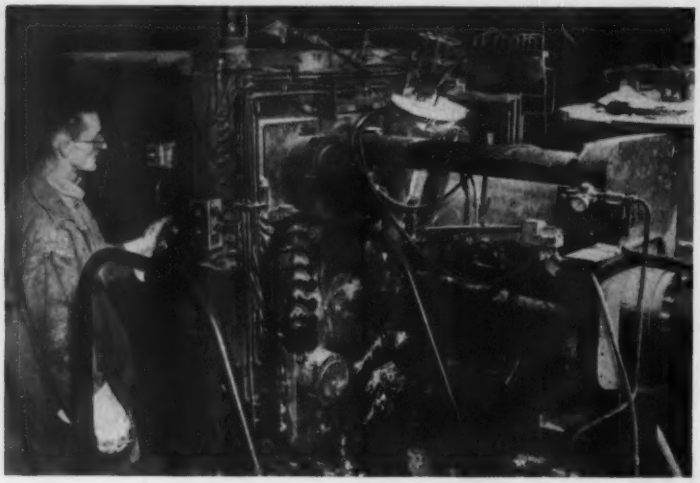
GENERAL FOODS' NEW UNICORE BINDER FLOUR . . . PROCESSED TO YOUR OWN DENSITY NEEDS . . . GUARANTEED UNIFORMITY . . . CAN SAVE YOU 20% IN BINDER COSTS!

G.F.'s new UNICORE process is an advanced technical development in the production of foundry binder flour. Rigid control now permits you to choose the binder density —ranging from 425 to 600 grams—that suits your operation best. Some foundries have actually discovered they can reduce the usage level of UNICORE and save up to 20% in binder costs while maintaining their high-quality standards. The difference is the new UNICORE process which develops unusual physical properties in addition to those measurable by standard lab tests. You can prove UNICORE's quality in your core room. Send for a free sample today: General Foods Corn Mill, 1551 E. Willow St., Kankakee, Ill.

For More Information Circle 709, Page 39



A 2000-ton cold chamber diecasting machine (shown above) was acquired to cast magnesium auto instrument panels. Metering valve on machine (shown below) measures magnesium flowing into cold



This assortment of magnesium diecastings typifies range of parts made for automobile fuel pumps and oil filter valves

DIECASTING

at AC Spark Plug Division

By ROBERT H. HERRMANN
Associate Editor

● DIECASTING operations at A C Spark Plug Div., General Motors Corp., Flint, Mich., are divided into two production sections. Functional parts, cast of zinc, aluminum, and magnesium, are made in one section, and decorative parts, cast of zinc, are produced in another section near the finished parts assembly area.

Most of the zinc castings are painted or chromium plated in facilities at this plant. Many zinc castings also are used in speedometers and in instrument panels produced and assembled here for GM automobiles and trucks. Between 3 and 3½ million pounds of zinc diecastings are produced monthly.

A majority of aluminum diecastings are fuel pump parts and oil filter bodies. Monthly production of aluminum castings is about 145,000 lb. Magnesium diecasting production of about 300,000 lb a month is made up mostly of fuel pump parts and instrument clusters.

Discuss Advantages—Robert Haverberg, chief manufacturing and development engineer, discussed the relative advantages of zinc, aluminum, and magnesium diecastings. Factors involved include the interrelation of price per pound, relative weight, die mold life, and heat transfer properties of the three metals.

Even though aluminum and magnesium cost more per pound than zinc, the metal cost of a given aluminum casting is about 65 per cent that of a zinc casting due to

In iron foundries today the trend is to...

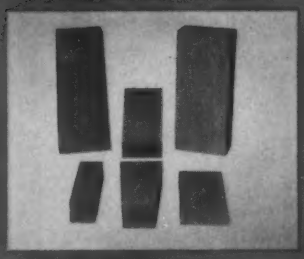
NATIONAL
TRADE-MARK

CARBON AND GRAPHITE PRODUCTS

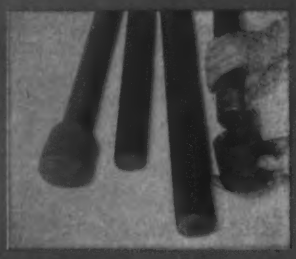
When your operations require refractories to handle molten irons either inside or outside the cupola, you'll realize economic advantages when you use "National" carbon and graphite products. Why? Because carbon and graphite have no melting point... resist slag and thermal shock... are not wet by molten irons... have low thermal expansion... increase in strength with increase in temperature.

Whether you use carbon block and brick for lining cupolas and runout troughs... carbon paste for patching ... graphite tubes for injection and upgrading of iron... graphite plungers for producing ductile iron... or core rods and chill plates—you'll find these products all help reduce maintenance, speed production and lower overall costs. For details write National Carbon Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. In Canada: Union Carbide Canada Limited, Toronto.

CARBON BLOCKS—Provide long refractory life in the cupola.



CARBON BRICK AND PASTE—Proved materials for cupolas and runout troughs.



GRAPHITE TUBES—Unsurpassed for introducing graphite powder for injection and upgrading of gray iron.

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difference in specific gravity; magnesium is about 60 per cent of zinc cost.

The average life of dies for aluminum castings is about 100,000 shots, for magnesium it is about 250,000 shots, and for zinc it is about 500,000 shots.

The diecasting machine cycle rate for magnesium can be about twice that of aluminum; it is about the same as that for zinc. The faster cycle claimed for magnesium is explained by the fact that magnesium freezes more rapidly than does aluminum.

The lightness of magnesium, which has a direct effect on the handling of parts in production and on shipping, also will have a bearing on its increased use, according to Mr. Haverberg.

He adds, however, that the metal is not without some problems. It is a little more difficult to cast than the other metals. Its freezing pattern is such that brittle areas may develop if the casting and the dies are not properly designed to avoid stress areas and to promote proper cooling.

Thirty per cent of the dies used at A C Spark Plug are made in the company's machine shop. All are made of H-13 steel.

Automatic Machines—Many of the diecasting machines at the plant are equipped for automatic operation. Automatic metering of aluminum in the cold chamber machines is by application of a partial vacuum to the die. The negative pressure of 10 to 26 in. Hg exerted through the die and chamber to the metal supply draws molten aluminum into the chamber. A piston then pushes the metal into the die.

Of the seven machines casting magnesium, two have metering systems similar to those of the aluminum diecasting machines. The other machines employ gravity metal flow from a holding furnace to a stainless steel valve mounted in a housing. Gas heaters maintain the valve at the desired temperature, and an atmosphere of sulfur dioxide is maintained around the valve in the housing to prevent fires. The valve, operated by an air cylinder, permits a predetermined amount of metal to flow into the cold chamber for injection by plunger to the die cavity.

A majority of the machines in the plant are equipped for automatic casting removal. Ejection pins push the castings out of the open dies. Larger castings fall to a tank of water under the machine and an inclined slat conveyor which traverses the bottom of the tank carries the castings to a tote box.

Smaller castings fall to a chute and then to a belt conveyor or to a tote box for movement to a subsequent operation.

A continuing plan of modernization is underway at the plant. Recent acquisitions include aluminum and magnesium casting machines of general size plus a 2000-ton cold chamber machine primarily for producing magnesium automobile instrument panels.

Future additions are to include trim presses to handle individual diecasting machine production and the installation of conveyors to handle cast parts through processing and assembly operations in straight line production flow.

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NO. 8 is a direct, easily applied, accurate graphitizer. Either the funnel or the envelope methods can be utilized to apply NO. 8 to the molten metal.

NO. 8 improves strength, wear and shock resistance. The transverse strength of treated iron can be increased and better wear and shock resistance realized by improving the micro structure. Dendritic graphite and massive carbide formations are converted to normal flake patterns and pearlite.

NO. 8 is a powerful inoculant. It plants graphite *throughout* the molten metal. These "seeds" of graphite act as centers on which carbon dissolved in the molten metal may precipitate and grow as graphite while the casting is poured and the metal cools.

NO. 8 makes castings metallurgically more uniform. Photomicrographs show that iron treated with NO. 8 has a normal flake pattern throughout the section.

NO. 8 makes castings more machinable. With the addition of NO. 8, massive carbides are less likely to occur, and the metallurgical structure becomes more uniform from center to outside with a much better distributed graphite pattern.

NO. 8 is effective for special metallurgical control. For example, when iron is treated with NO. 8, an increase from 10 to 30% in deflection over the base iron value is usual. This means less cracked castings and greater yield.

NO. 8 reduces chill and hardness. For example, in untreated iron the Brinell hardness (wedge bar) was reduced from 229 to 217; total chill depth reduced from 41/32 in. to 13/32 in., and the clear chill from 26/32 in. to 10/32 in. with 1# of NO. 8 per ton of iron.

NO. 8 substantially reduces the expense of metal treatment. By employing NO. 8 to inoculate gray iron, costs are kept to less than 10¢ per ton of metal treated.

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GF-288-1

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Inland Steel Plans Ingot Mold Foundry

CHICAGO—Inland Steel Co. plans to build a foundry for casting ingot molds and stools at its Indiana Harbor Works in East Chicago, Ind. Construction will begin later this year, and completion will be in 1963. Cost is not disclosed other than that it "will be a multimillion dollar project."

The foundry, with a capacity for casting 150,000 tons a year, will make all the ingot molds and stools for the plant's three open-hearth shops. This, it is stated, will be enough to meet the company's needs at capacity levels of operation. However, the facility will be constructed so that it can be expanded readily and economically. It will provide employment for approximately 170 men.

The shop will produce the 15 different molds used in casting ingots. Molds and stools are one of the four major items of cost in open-hearth operations, being about equal to fuel, labor, and furnace rebuilding in cost per ton.

The molten iron from which the molds and stools will be cast will be produced by Inland blast furnaces. Mold iron specifications vary only slightly from the pig iron normally produced at the Indiana Harbor Works.

The foundry will be housed in a 200 x 500-ft building to be built directly west of No. 3 open hearth in Plant 2. Included will be a laboratory and welding facilities.

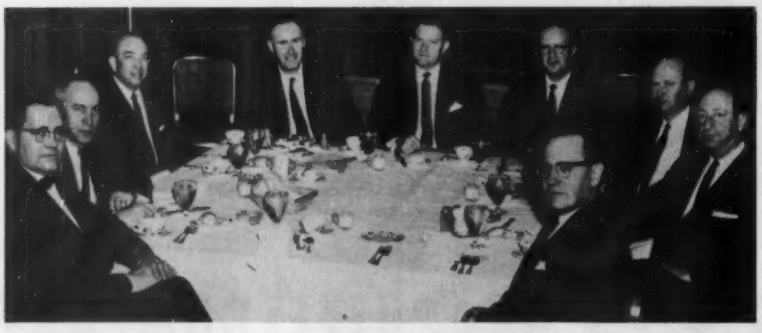
* * *

International Harvester Co.'s shutdown operations at its McCormick Works, Chicago, originally planned to be completed by the end of 1961, is ahead of schedule, and some of the 45 buildings already are being razed.

Malleable foundry operations were transferred to Harvester's Waukesha, Wis., works some time ago, but nodular iron production and malleable annealing operations were to continue until this fall. Now, the annealing work is about to terminate and the nodular iron output will be shifted to the company's Memphis, Tenn., foundry by June 2.

Thus comes to an end a long-time Chicago area foundry operation. McCormick Works was established in 1847, and for six decades until the 1930's it was the world's largest farm implement plant. The McCormick harvester and some of the early models of the now widely-used harvester-threshers were built in the plant.

Decision to abandon McCormick Works, according to Mark V. Keeler, vice president of the company's farm equipment division, was prompted by trends in agriculture and the farm equipment market as well as the age and conditions of the buildings. "We cannot afford to manufacture in an obsolete and high-cost factory like McCormick Works when we have more efficient space available at other plants," he stated.



Establishment of a Ductile Iron Section of Gray Iron Founders' Society was recommended by the society's Ductile Iron Committee at a meeting in Cleveland on March 30. Left to right around the table are Donald H. Workman, Richard C. Meloy, John W. Perry Jr., Prof. John F. Wallace, Charles Glenn, George H. Tompkins, Edward L. Roth, Hermann P. Good, and John F. McIntyre

To Form Ductile Iron Section

CLEVELAND—Establishment of a Ductile Iron Section of the Gray Iron Founders' Society was recommended by the Ductile Iron Committee of GIFS at a meeting in Cleveland on March 30. The new section would be responsible for a hard-hitting promotional and educational program.

Plans call for an annual meeting of the 75 ductile iron producers who are members of GIFS. The first is expected to be held early this summer in the new Metallurgical Building at Case Institute of Technology, Cleveland. At that time, current GIFS research data on heat treatment of ductile iron will be revealed.

Present at the planning meeting were Donald H. Workman, GIFS; Richard C. Meloy, GIFS; John W. Perry Jr., Grede Foundries Inc., committee chairman; Prof. John F. Wallace, Case Institute, guest; Charles Glenn, Lynchburg Foundry Co.; George H. Tompkins, Black-Clawson Co.; Edward L. Roth, Motor Castings Co.; Hermann P. Good, Textile Machine Works; John F. McIntyre, Sibley Machine & Foundry Corp., GIFS president; and Robert W. Jordan, Hamilton Foundry Inc.

Slow Pickup in Eastern Area

PHILADELPHIA—The Eastern Co., Naugatuck, Conn., (formerly Eastern Malleable) closed its mal-

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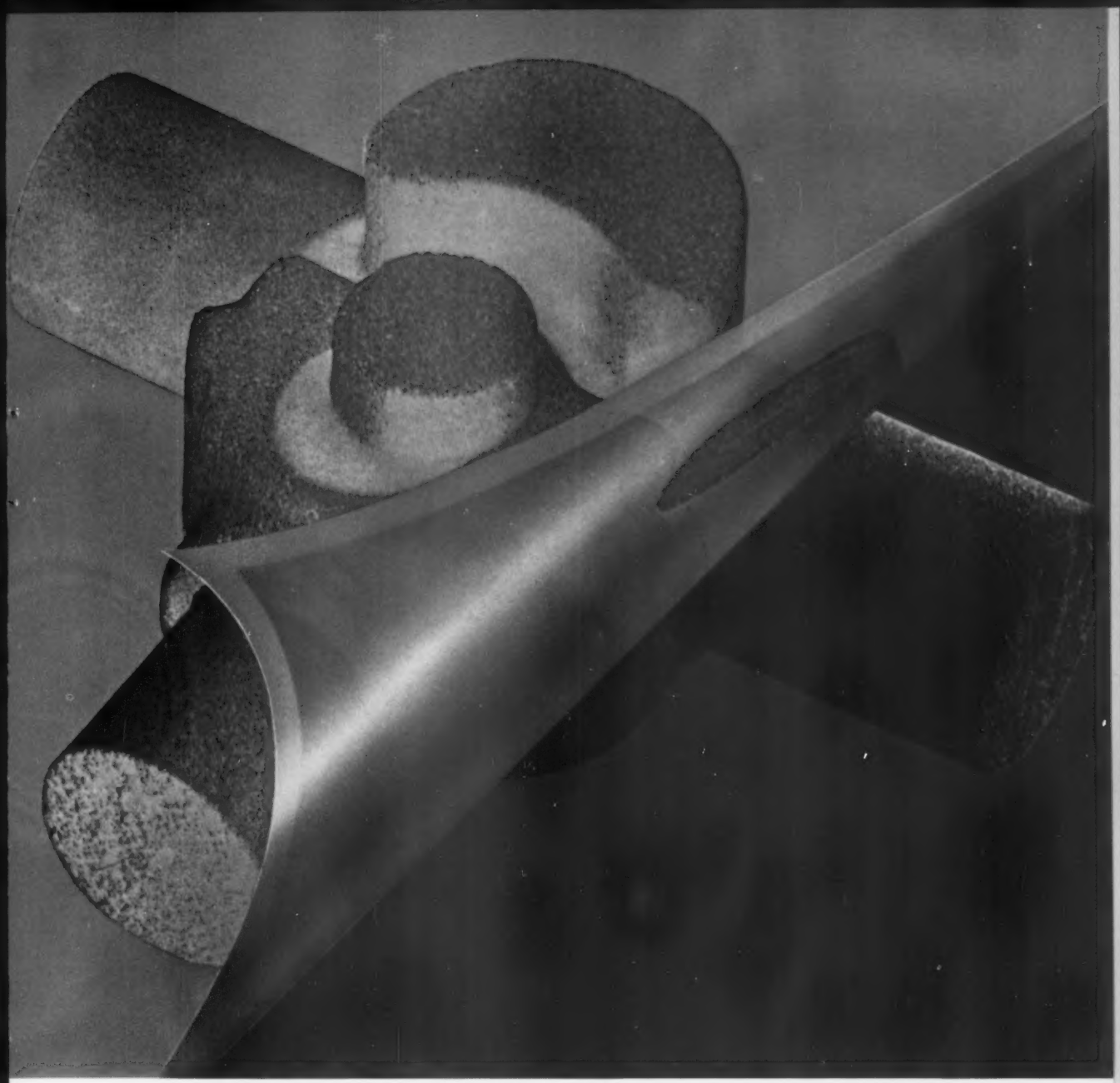

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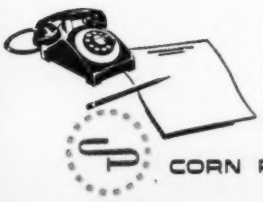

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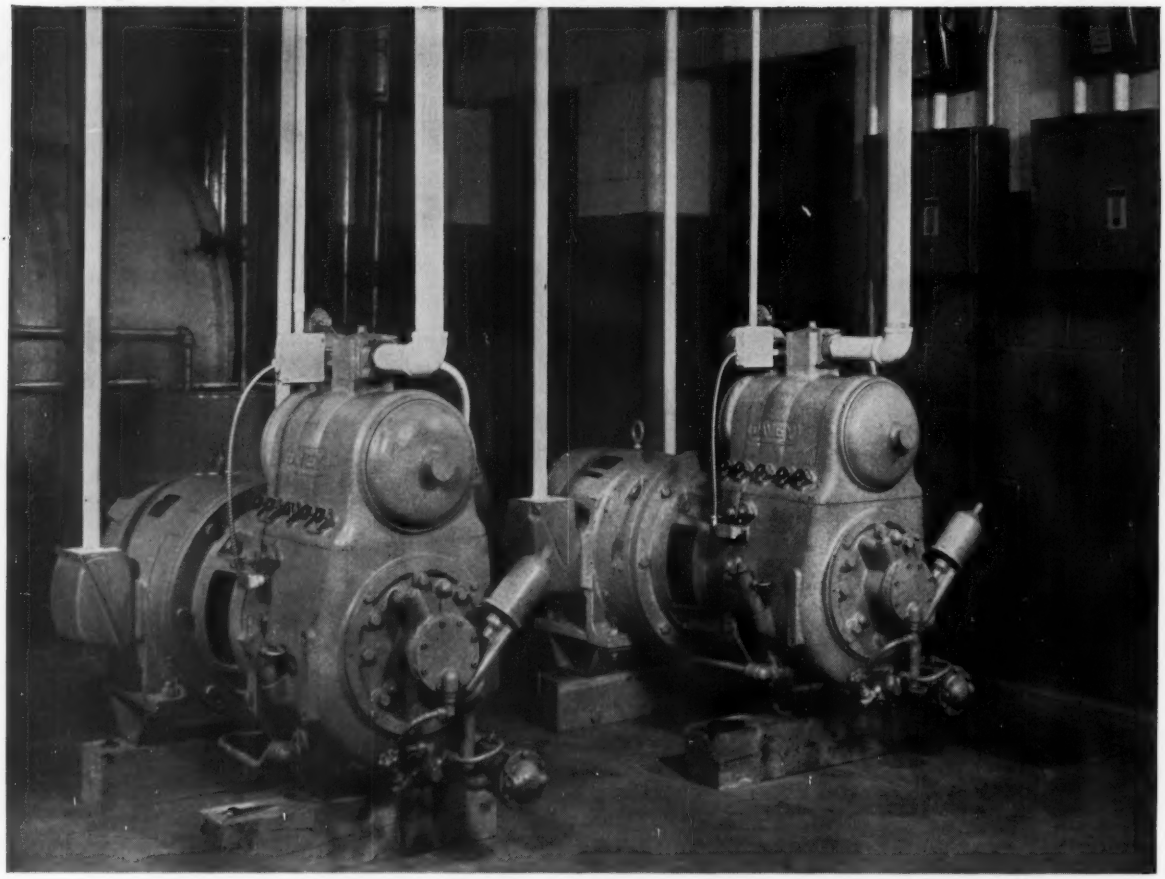

These 2 Davey 40 h.p. Hydrovanes each deliver 166 c.f.m. of free air for a plastics manufacturer. Unit No. 1, installed in mid-1957, has operated 24 hours a day, 5½ days a week, without shutdown. Machine No. 2 is now in its 6th month of trouble-free service. Note: both compressors are attached to wood blocks, illustrating simplicity of mounting.

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Inexpensive to install • Economical to operate
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Only one compressor—the Davey Hydrovane Rotary—meets needs of modern production.

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Only Davey offers a complete line of 2 to 125 h.p. rotary stationary compressors for 100 p.s.i. operation.

For facts about today's *only really modern* compressors, see your local Davey distributor. Or write for Bulletin E. A-1276A

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leable foundry in Wilmington, Del., April 30. Disposal of the property is yet to be announced.

Occupying 375,000 square feet, the plant in recent years operated two air furnaces and employed 180 persons. It was built in 1905 and had been affiliated with Eastern since 1912.

The company continues to operate three other foundries: Alloy Foundries Div., Naugatuck, Conn., producing malleable, pearlitic, aluminum and stainless steel castings (sand and shell molding); Frazer & Jones Co., Syracuse, N. Y., producing malleable castings, including highway expansion joints; and Eastern Castings Co., Newburgh, N. Y., producing permanent mold aluminum castings and diecastings.

The company also is engaged in various other activities. Its Pattin Mfg. Div., Marietta, O., turns out mine roof bolts and expansion shells. The Eberhard Mfg. Co. Div., Cleveland, manufactures truck and trailer locks and marine bilge pumps; and Eastern Sales Co. Div., Pittsburgh, handles universal and groove pipe couplings.

Its Danforth Anchor division, Portland, Me., said to be the largest manufacturer of small boat anchors in the world, has just been merged with the newly acquired Wilfrid O. White Co., Boston, manufacturer of boat compasses, depth sounders, automatic pilots, and weather instruments. The two components will be operated as the Danforth-White Div.

A touch-and-go business situation still prevails among foundries here. There is a mild improvement in most categories, but demand continues spotty.

Gray iron operations average slightly better than 65 per cent, with some gains in building supplies, gear assemblies, material handling equipment and pump work. Textile machine requirements have leveled off. Specifications from printing machinery manufacturers remain active but papermaking machinery needs have slowed down somewhat recently.

Indicative of low consumer stocks is an increasing number of rush inquiries, with confirming orders coming along later. One leading job shop reports that by far the great majority of inquiries are of this type.

Steel foundry operations hover around 63-65 per cent of normal, some trade leaders estimate. Some shops are operating five days a week, six to seven hours a day. Delivery promises range around five weeks. There is a fair amount of valve fit-

"Charlie wants to prove to his boss that he was here"

WHEN you consider that *cleaning room costs* are a part of the cost of your product—anything that reduces these costs will automatically increase your profits. It is natural to be a skeptic when you read this statement: "National Metal's **Perma-Steel®** will last as long and clean as well as steel abrasives—and it costs substantially less."

But supposing it's true? Supposing we can prove it to you in your own operation without upsetting your routine? Supposing we CAN make an abrasive with controlled specifications? Supposing we CAN save you money? Being a skeptic is natural. Being obstinate can be costly. What's wrong with listening to our story?

If you are using chilled iron abrasives, we can prove that **New Controlled "T"®**—or **Permabrasive®** would sharply reduce your costs. Be a skeptic, but be an open-minded one. Write for National Metal's free booklet: "The Facts of Life Concerning the Use of Shot and Grit."

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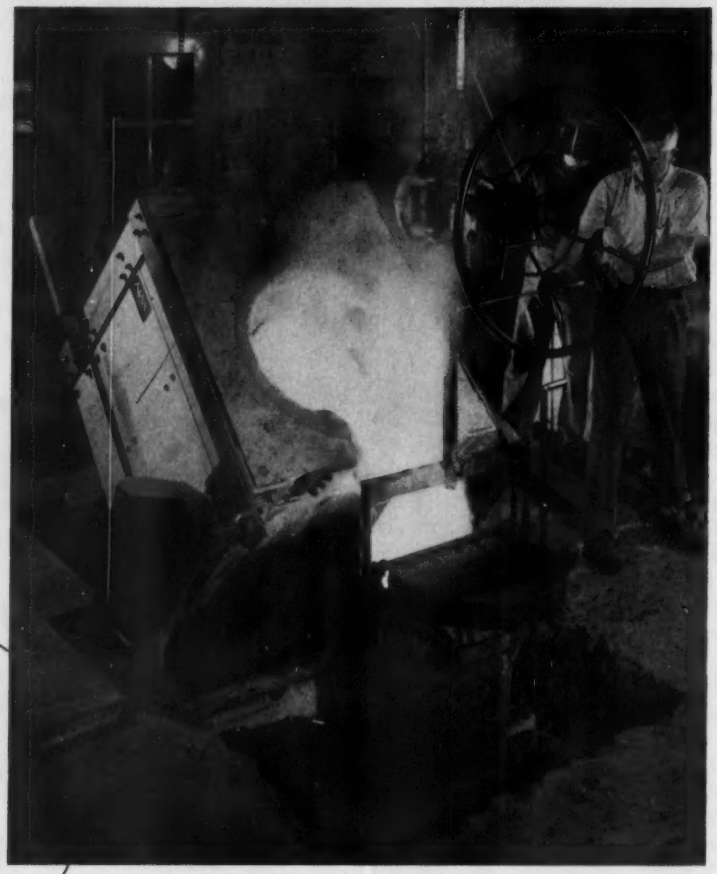
For More Information Circle 715, Page 39

WITH TAYLOR ZIRCON RAMMING MIX

Mould Manufacturer cuts induction furnace lining costs by

50%



Pouring a heat of grey iron from 650 lb. high frequency induction furnace lined with TAYLOR ZIRCON No. 717 Ramming Mix.

TAYLOR ZIRCON No. 717 Ramming Mix has cut refractory lining costs *in half* for a mid-west mould manufacturer. In addition, average number of heats has increased. This company melts grey iron in 650 lb. and 1000 lb. induction furnaces to produce moulds for the glass industry.

Alert foundries are standardizing on TAYLOR ZIRCON Ramming Mix as the most economical lining for high frequency furnaces. High softening point, low thermal conductivity, high di-electric strength, and volume stability make TAYLOR ZIRCON an excellent refractory for this service. For detailed information, write direct, or call in a Taylor field engineer.

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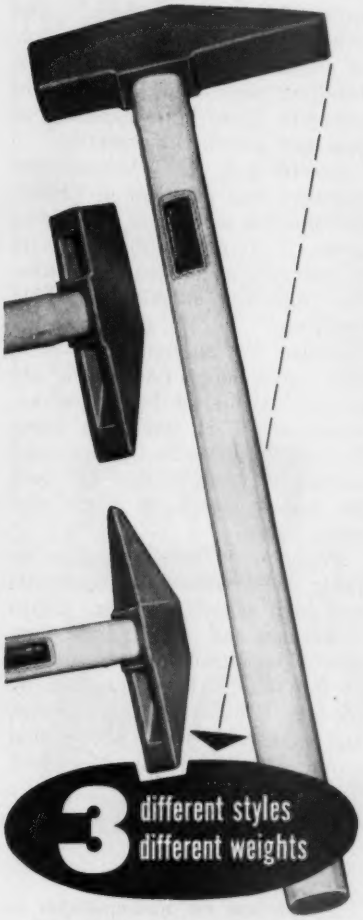

It never pays to use makeshift tools for cupola work. Industrial's Cupola Picks are designed for the job by people who know foundry needs. They do it better, faster—keep replacement costs down.

These rugged, well balanced picks are made of nickel/chrome/moly steel, heat treated to proper hardness, with face and edges ground. Select quality, straight grain hickory handles are 23" long.

Write Factory or ask your Foundry Equipment Dealer for descriptive literature.

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tings and oil refinery work, but there is a lag in heavy electrical equipment specifications, and in general, heavy capital needs are slow. Also, ship work lags, although one district yard has work which should develop into tonnage this spring.

Bronze and brass castings remain slow. The red metal shops are operating at 50-55 per cent of normal, with buying largely on a spot basis. Light metal shops relatively, are operating on a much better basis, but business has shown little change lately.

Malleable tonnage reflects some pickup in building hardware, transmission tower work, and contined active demand from pleasure craft builders.

Most casting production in this immediate area, however, is devoted to pipe fittings. This business still lags, with imports cutting into domestic sales.

Book Review

A Visit With "500" Die Cast Plants, by Ed. A. Day, paper cover, 600 pages, 8½ x 11 in., published by American Charcoal Co., 201 S. Green, Detroit 17, Mich. Price, $10.

Book was written to enumerate and explain diecasting practices in use throughout the country. Text was developed from material gathered by the author and from contributions from equipment suppliers, diecasters, and others associated with the industry.

Diecasting of aluminum, magnesium, and zinc are dealt with extensively. Building, use, and repair of diecasting dies is discussed as are problems of gating and heat transfer. Details are given on melting and processing of diecasting metals and the various types of furnaces which are used.

Several models of diecasting machines plus auxiliary tools and equipment are described in some detail. Finishing operations, including buffing, plating, and treating with chemicals, are covered.

Several chapters are devoted to other casting processes which are competing with diecasting or which may be competing in the future. These are presented so that the diecaster can understand the advantages and limitations of these methods in relation to his own.

Circle 718, Page 39→

how we help you make the plunge

Much of the ductile iron now being produced uses the plunging technique. Increased magnesium recovery, improved control and lower cost result. Flame and smoke are virtually eliminated and cleaner metal is produced.

Many producers plunge Ohio Ferro-Alloys' Sil-Mag alloys.

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Also available without Rare Earth Metals.

They offer consistent recovery, uniform properties and lowest treating cost.

If you are not taking advantage of the plunging technique, we would be happy to have our qualified foundry service personnel discuss this method with you. Detailed information on ductile iron and alloying techniques is presented in our brochures, **Sil-Mag Alloys for Ductile Iron** and **Plunging Sil-Mag Alloys**. A copy is yours for the asking.

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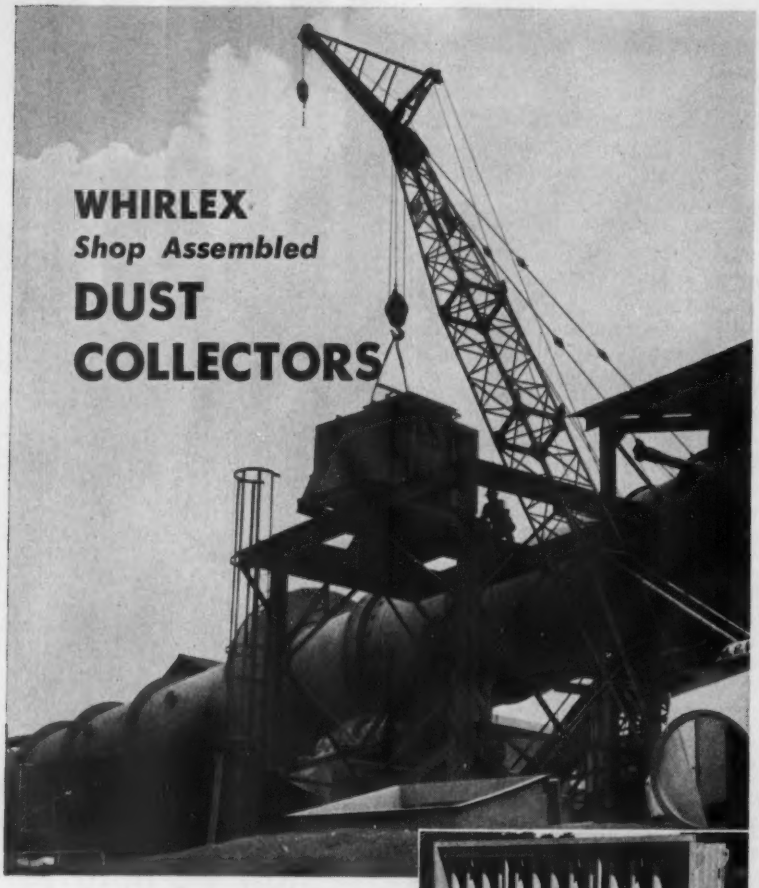

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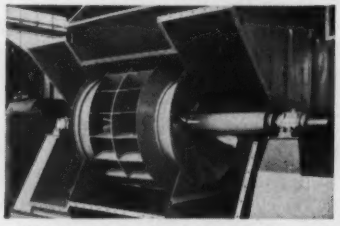
Whirlex Dust Collector completely fabricated and ready for shipment



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Conveyor Association Releases Movie on Materials Handling

The Conveyor Equipment Manufacturers Association has just released a new color motion picture entitled "It's Your Move." The new film dramatizes the principle of continuous flow in materials handling with a wide variety of examples from bulk handling of coal and gravel to automation.

According to R. C. Sollenberger, executive vice president of CEMA, the film will serve three major purposes: 1. It reveals the versatility of conveyor manufacturers in solving difficult material handling problems. 2. It generates enthusiasm for mechanization at a time when many Americans are skeptical about the benefits of automation. 3. It reveals to youth the opportunities in creative engineering of the type that has built the leading companies of the conveyor industry.

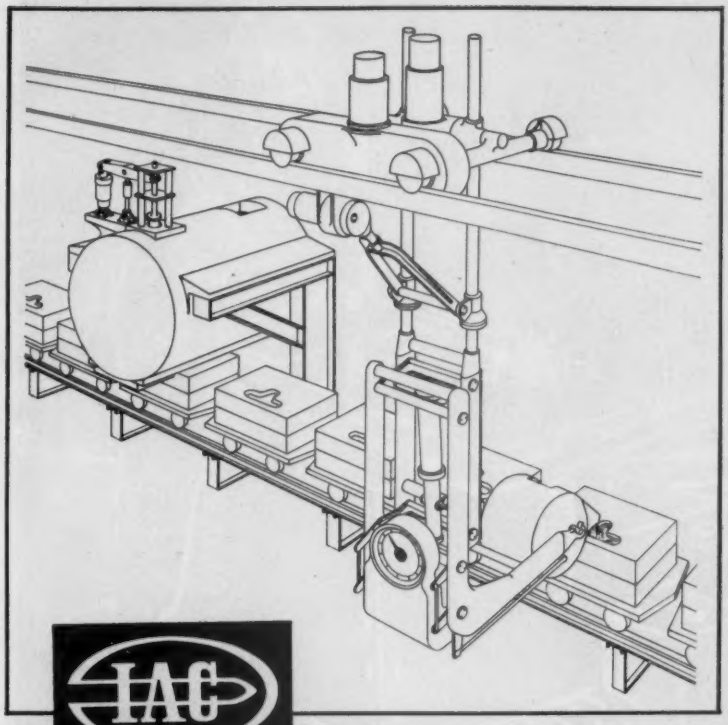
Prints of the 24-minute film are being made available to vocational and high schools, colleges, groups in business and industry, and community organizations. Distribution of the film is being handled by Modern Talking Picture Service, and requests should be sent to that group at 3 E. 54th St., New York 22, N. Y.

Book Review

Symposium on Radioisotopes in Metals Analysis and Testing, **hard cover, 64 pages, 6 x 9 in., published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price $2.75.**

Symposium on radioisotopes presents several specific applications in analysis of metals and reviews instruments and techniques available to the analyst with the purpose of stimulating thinking in the application for this type of analysis.

Chapters include Nucleonics in Analysis, Instrumentation for Nucleonics, Metals Analysis by Radioactivation, Principles of Isotope Dilution Assays, Neutron Activation Analysis of Traces of Molybdenum in Tungsten, Application of the (n, a) Reaction, Experience with Neutron Activation in the Analysis of Aluminum, and Training Industrial Personnel in Radioisotope Utilization.



this fully automated pouring device

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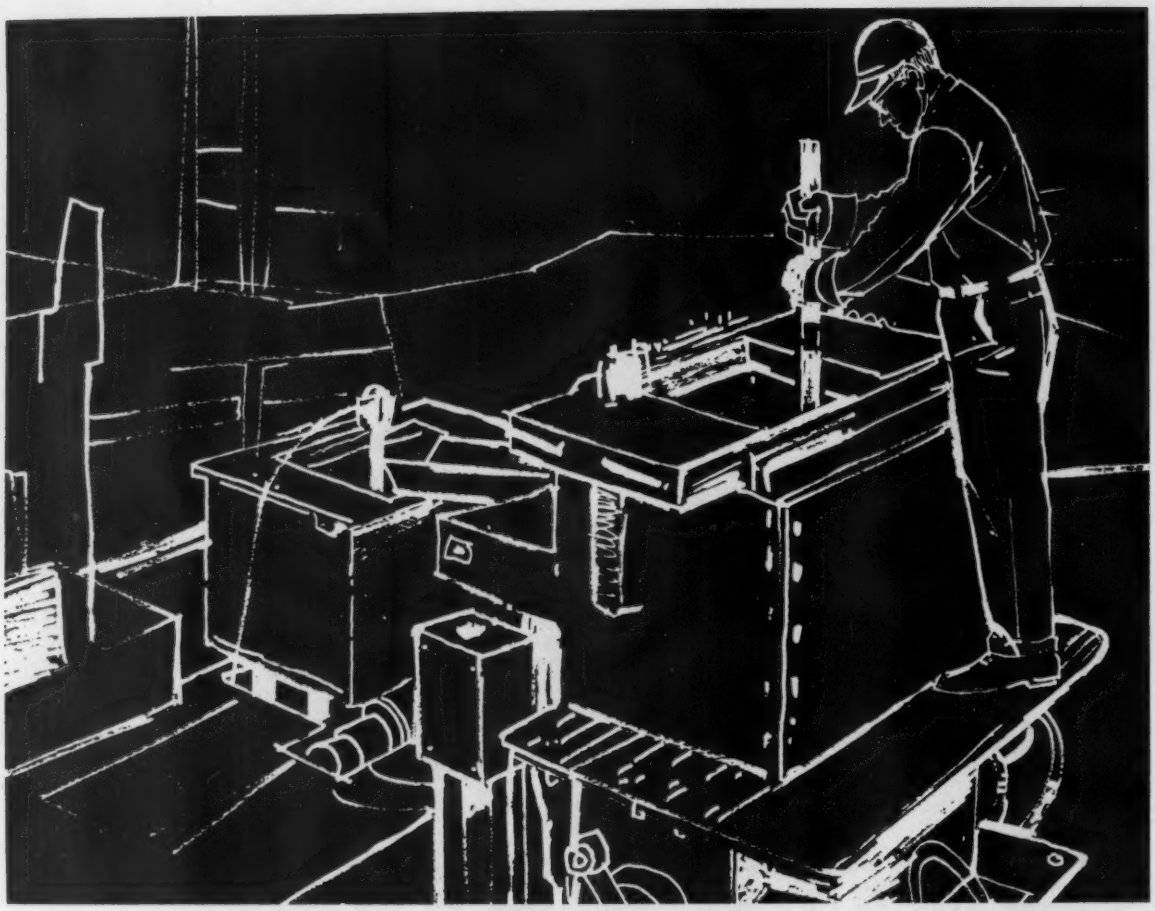

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Fewer shutdowns mean greater production . . . enable you to maintain higher quality in your product! The new Alcoa® Induction Furnace Grade Ingot is really clean! It not only reduces oxide particles that cause deposits in induction furnaces, but also cuts skim and dross losses.

Customers who are using this ingot report a significant reduction in the amount of material depositing in the channels of their furnaces.

For more information on this new Alcoa Aluminum Ingot—available at no increase in price—call your nearest Alcoa sales office. Or write: Aluminum Company of America, 863-E Alcoa Building, Pittsburgh 19, Pa.

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ALCOA ALUMINUM
INGOT

Members of the Castings Section, American Ordnance Association, who attended its second annual meeting, held at the Detroit Arsenal (U. S. Army Photograph)

Ordnance Section Discusses

CASTING RELIABILITY

● CASTING RELIABILITY was the theme of the second annual meeting of the Castings Section, Production Techniques Division, American Ordnance Association, held at the Detroit Arsenal, March 9-10. Attendance included about 100 representatives of the foundry industry, the Ordnance Tank Automotive Command, and other military agencies.

Current and proposed methods intended to improve the reliability of castings used for military purposes were discussed in various papers. The technical program was arranged under the chairmanship of B. C. Yearley, National Malleable & Steel Castings Co., Cleveland. Collins L. Carter, Albion Malleable Iron Co., Albion, Mich., deputy chairman of the AOA Castings Section, presided.

Visitors were welcomed at the opening session by Brig. Gen. J. F. Thorlin, commanding general, Ordnance Tank Automotive Command. This was followed by a tour of the Arsenal. Remainder of the program was devoted to technical talks.

The casting process offers certain advantages over other methods in the production of shells, it was stated by Maj. Gen. W. Ghormley, commanding general, Special Weapons and Ammunition Command, Picatinny Arsenal, Dover, N. J. Discussing "Cast Shell—a Look into the Future," he said that production of cast pearlitic malleable shells to date has shown the required reliability and that additional assistance from foundries is sought in developing the program further.

"Ultrasonic Inspection of Malleable Cast Iron Shell," by William Pryor, inspection engineering, Frankford Arsenal, Philadelphia, described development of a special machine which automatically tests each shell ultrasonically at a rate of six shells a minute.

"Designing a Satisfactory Stress Distribution into a Cast Shape," by John B. Caine, consultant, Cincinnati, illustrated examples of how correct design of a part can improve its strength through reduction or elimination of stress concentration.

Some of the technical and nontechnical problems barring the more widespread use of castings for military purposes were cited by Col. Wilbur Carter, Aeronautical Systems Center, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio.

In a talk entitled "Casting Reliability Through Design," Carl Gerlach, American Society for Metals, outlined the contents of a castings design handbook being prepared by ASM under sponsorship of the Air Materiel Command. It will include contributions by 125 foundries and aircraft companies.

Various factors affecting the physical properties of cast and wrought ferrous products were discussed by Roger F. Waindle, Wai-Met Alloys Co., Dearborn, Mich., in speaking on "Specifying Reliability."

What is included in a typical specification was detailed in "Philosophy, Purpose and Preparation of Government Material Specifications," by Kenneth G. Abbott, Chief, Weapons Materiel Section, Watertown Arsenal, Watertown, N. Y.

"Quality Assurance Through Supplier Certification," by D. V. Wintermue, manager, supplier qual-

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For More Information Circle 751, Page 39

ity assurance, International Business Machines Corp., Endicott, N. Y., described that company's method of controlling quality of products it buys. A certification agreement, when made by IBM with a supplier, spells out applicable specifications and standards, quality levels required, inspection methods to be followed, and other quality control factors. The plan is reported to have worked out to the satisfaction of both the company and its suppliers.

Today's trend is toward more comprehensive testing of materials, it was indicated by Joseph B. Hayes, deputy director, research and engineering, Detroit Arsenal, in discussing "Assurance of Casting Reliability at OTAC." Design, production, and inspection are the factors affecting the degree of reliability attained, he said.

How the AOA Castings Section and the Armed Services can work together was discussed in "Castings Section Advisory Services," by Collins L. Carter, and "Utilization of the Castings Section by the Armed Services," by Henry Handler, special assistant to Chief of Ordnance for Technical Relations, U. S. Army.

At a dinner held the evening of the first day, the principal speaker was William G. Gude, editor, FOUNDRY, who discussed "Castings and the National Defense."

Book Review

Extractive Metallurgy by Joseph Newton, cloth, 532 pages, 5¾ x 9 in., published by John Wiley & Sons Inc., New York. Price $9.75.

Essentially a revision and enlargement of the second part of the author's *Introduction to Metallurgy*, second edition, the book follows the unit process method rather than the metal-by-metal basis, discussing basic principles rather than detailed practice. In addition to the subjects covered in extractive metallurgy, some discussion of metal crystals, equilibrium diagrams, and Gibb's phase rule is included.

First three chapters deal with sources of metals, ore dressing, and chemical principles. Other chapters discuss structure of metals and alloys, fuels and refractories, pyrometallurgy, hydrometallurgy, electrometallurgy, and ingots.

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For More Information Circle 753, Page 39

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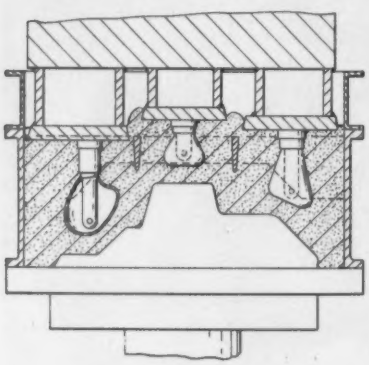
PATENTS of INTEREST

Molding Machine

Machine designed to produce foundry molds without the necessity of employing the usual jolting action incorporates a squeezing operation as well as probes located in various sections for compacting the sand. Probes are hollow members covered with a distendible membrane of rubber or other elastomer which are expanded into balloon-like shapes by high-pressure air or water. Probes are attached to the machine squeeze head, and additionally may be arranged to enter the sides of



the flasks through suitable openings therein.

In operation, the sand in the flask is subjected to squeezing, and while still under that pressure high-pressure fluid is admitted to the probes, expanding the membranes and causing further compaction of the sand. **Patent No. 2,968,846 granted to L. F. Miller, and assigned to Osborn Mfg. Co.**

Ductile Iron

Addition of lanthanum to gray iron containing less than 0.03 per cent sulfur results in a material which in the as-cast condition is soft, ductile, readily machinable, and possesses high tensile strength, high elongation and impact strength.

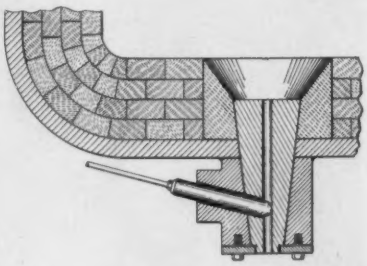
Essentially the procedure involves addition of an alloy of magnesium-silicon-cerium and of a high-lanthanum rare earth which results in retained amounts of 0.02 to 0.04 per cent magnesium, 0.02 to 0.05 per cent cerium, and 0.004 to 0.02 per cent lanthanum in the treated iron. **Patent No. 2,970,902 granted to A. P. Alexander and A. F. Spengler Jr. and assigned to International Harvester Co.**

Upgrading Iron

Method of upgrading gray iron consists of injecting into the molten composition from 5 to 75 pounds of finely divided calcium carbide per ton with or without addition simultaneously of other substances. Those materials include magnesium oxide with or without metallic magnesium, magnesium oxide with ferrosilicon or other silicon alloys, metallic magnesium or magnesium alloys, magnesium oxide with or without rare earth oxides, and chromium. **Patent No. 2,963,364 granted to J. M. Crockett and P. M. Hulme and assigned to Air Reduction Co. Inc.**

Ladle Valve

Hot metal valve for a ladle includes a nozzle frame attached to the ladle which contains a vertical circular passage enclosing a hard



carbon nozzle. A secondary circular passageway in the nozzle angularly disposed to the hot metal passageway contains a cylindrical hard carbon plug which can be rotated and moved into and out of the passageway. Plug and its passageway are at least twice the diameter of the hot metal passageway. **Patent No. 2,968,075 granted to W. E. Flickinger Sr. and George Dolenic.**

Surface Improvement

Alligatoring on the surface of alloy cast steels in the range of 1.50 to 2.50 per cent manganese, 0.75 to 3.00 per cent chromium, and 0.75 to 3.50 per cent nickel, particularly in heavy sections, is elimi-

Speaking of Patents . . .

● IT'S not generally known but Seth Boyden, father of the American malleable iron industry, had a brother, Otis, who was a foundryman and an inventor in his own right.

Almost exactly 110 years ago, Otis Boyden was granted U. S. Patent No. 8114 for a method of making wrought or malleable cast iron "either direct from the ores or from ordinary cast iron." The patent is titled "Improvement in Alloys of Iron, Zinc, and Nickel."

Boyden's invention calls for mixing metallic zinc, or an alloy of zinc and nickel, with crude iron or iron ores while in the fused state during the process of ordinary manufacture. One procedure was to prepare a master alloy of cast iron, 1 to 4 per cent zinc, and 0.25 per cent nickel.

Advantages claimed were that 1) the iron is more rapidly and easily "purified from all foreign admixtures and impurities," 2) it is more pure, dense, strong, ductile, and malleable, and 3) degree of hardness of the iron may be varied to suit any requirements.

What Otis did with his invention is not known. He operated a foundry in Newark, N. J., in 1835 and 1836, and in the latter year he was one of the incorporators of the short-lived Newark Malleable Iron Mfg. Co. Two other brothers, Alexander and Frank, also were malleable iron foundrymen in the early days.

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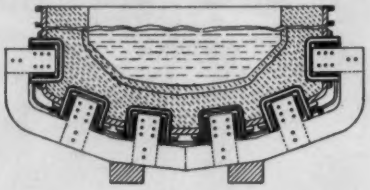
nated by addition of silicon, aluminum, and rare earth metals. Silicon must be present in the amount of at least 0.60 per cent, aluminum of at least 0.10 per cent of the molten metal, and rare earth in the amount of at least about 0.53 per cent by weight of the molten metal. **Patent No. 2,970,903 granted to C. G. Mickelson and assigned to American Steel Foundries.**

Stirring Molten Metal

Improvement in method of stirring molten metal baths by electromagnetic induction is shown in accompanying drawing. Furnace shell is low-cost steel containing



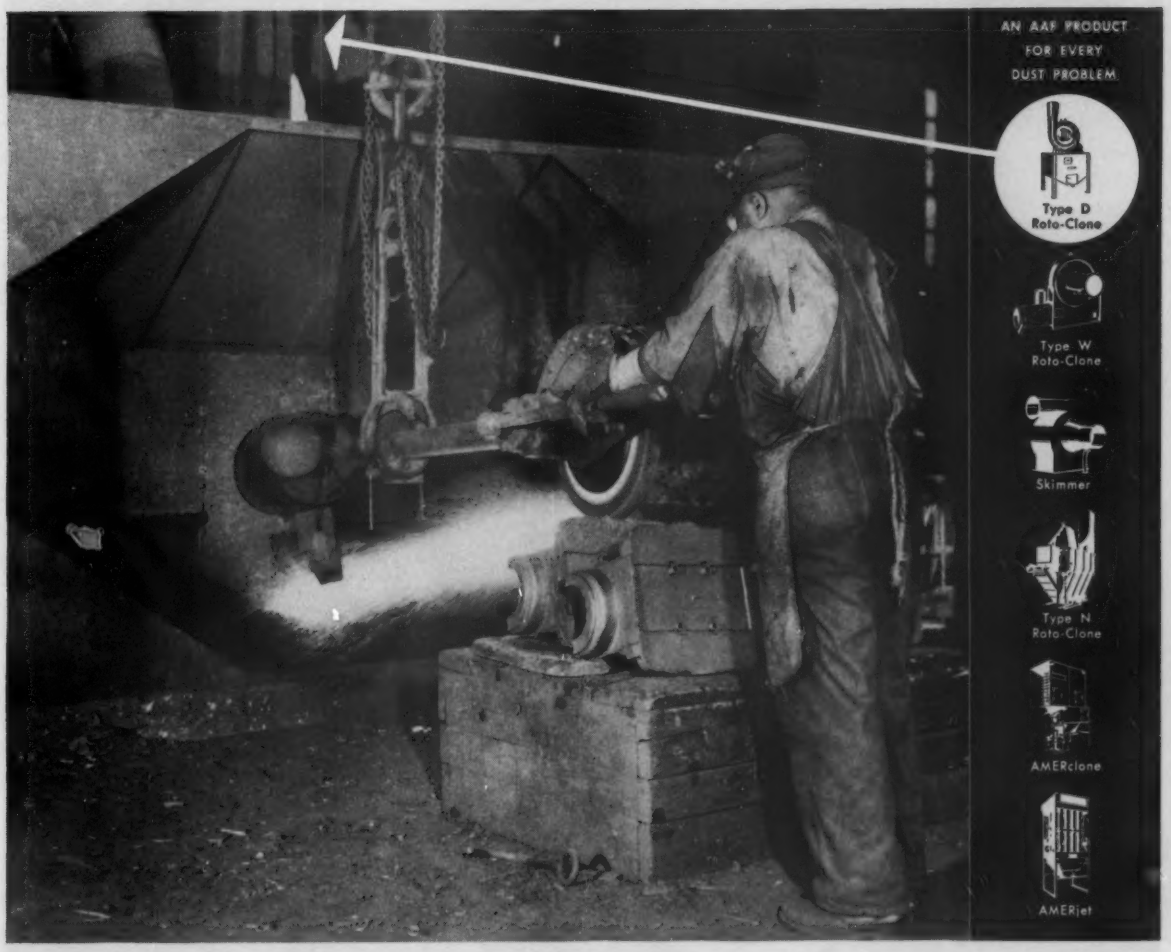
recesses on the under side to contain the water-cooled induction coils. Recesses in the shell are capped with nonmagnetic material, preferably high-temperature-resistant material, which permits penetration of the magnetic flux into the molten metal bath. Recesses permit close coupling and reduce amount of nonmagnetic material. **Patent No. 2,968,685 granted to Johannes Tostmann and assigned to Demag-Elektrometallurgie GmbH.**

Vacuum Die Casting

An arrangement to prevent entry of molten metal into a trap chamber attached to the vacuum line in a diecasting machine consists of a spring-loaded valve in the vent line or passage between die cavity and trap chamber.

A spring holds the valve in the open position, permitting the vacuum to be applied to the die cavity. When molten metal fills the die cavity and vent passage between die cavity and trap chamber, it strikes the face of the valve, causing it to close and preventing entry of metal into the trap chamber. **Patent No. 2,971,230 granted to T. E. Coleman and R. J. Schultz, and assigned to Madison Kipp Corp.**

GRINDING



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For More Information Circle 727, Page 39

Birth of a Gray Iron Casting—No. 3

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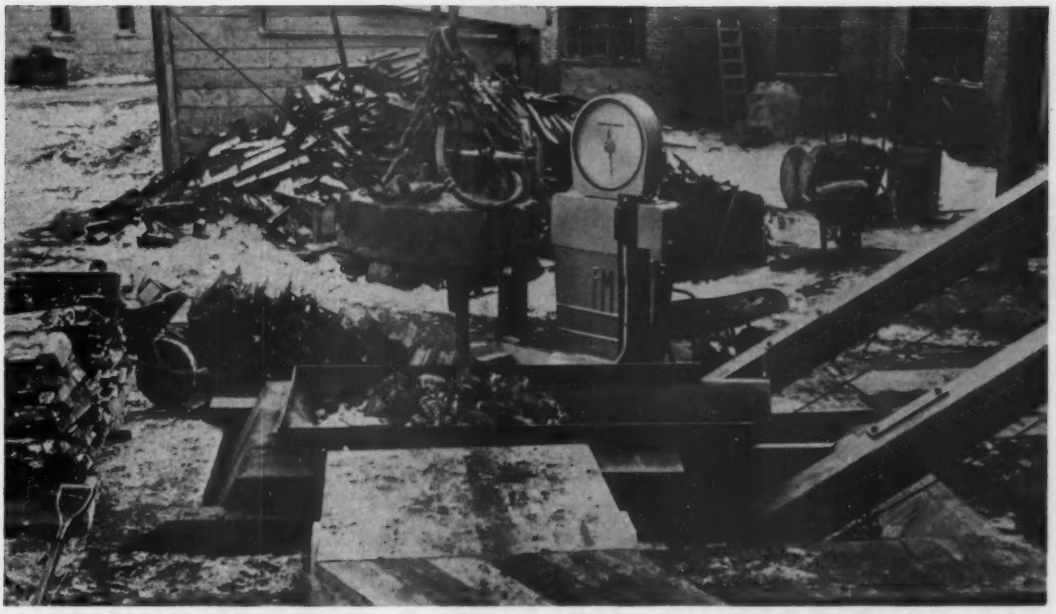


View of charger during loading shows the shallow pit required. Charger moves up skip track at right to the charging door in the cupola for unloading

CUPOLA CHARGER

Incorporates Vibrating Feeder

● A NEW TYPE of cupola charger installed recently at Lake Shore Inc., Marquette, Mich., features a rectangular vibrating feeder charger which is guided on a skip track to the charging door sill. Shallow pan design permits center feeding inside the cupola stack.

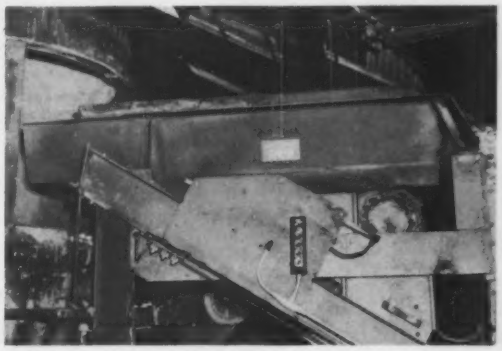
The load is fed into the stack uniformly over an 11 or 12-second cycle, thereby reducing coke breakage and minimizing compacting of the stock. It also results in better air distribution throughout the cupola charges. This factor promotes faster gas reaction time and higher metal temperature. Also, because of the vertical feeding, no heavy cast iron block, liners, and door sills are needed in the charging door area, and abrasion of the cupola lining is minimized.

The rectangular design provides a large target area for a magnet in the loading operation, and the shallow pan construction makes the charge readily accessible to the trimmer, permitting easy removal of excess material. A medium-sized cupola requires only a 5-ft charging door when the new charger is used. The smaller cupola door opening reduces danger to buildings and equipment from radiant heat.

After the unit has been loaded in the conventional manner, at ground level, it travels up the charging track and stops with the open end extending into the charging door opening. The charge is unloaded during a vibrating cycle, and the unit returns down the track to be loaded again.

The Lake Shore installation has a rated capacity of 2000 lb of metal plus stone and coke. Other models with 1000 and 4000-lb capacities and options of completely automatic charging, magnet charging, manual charging, or a combination of these features also are available.

The charger has no exposed moving parts in the charging door opening. It consists of a skip, feeder, hoist, controls, beam scale, charging track and supporting structure, and a shallow loading pit. Called the Cupoloader, it is a product of Brown Metals Inc., a subsidiary of Brown Fintube Co., Elyria, Ohio.



Cupola charger is ready for unloading cycle to be started. Unit is vibrated for 11 to 12 seconds for slow discharging instead of an instantaneous dumping

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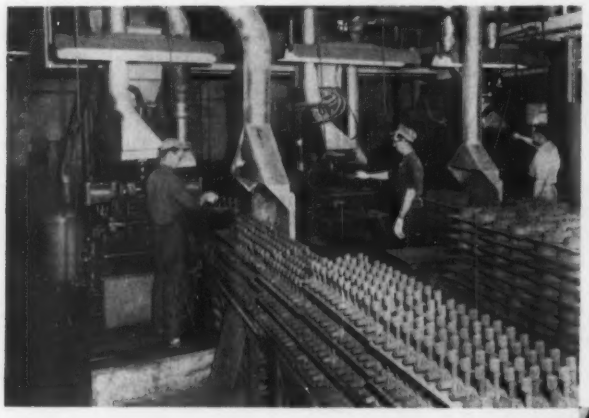

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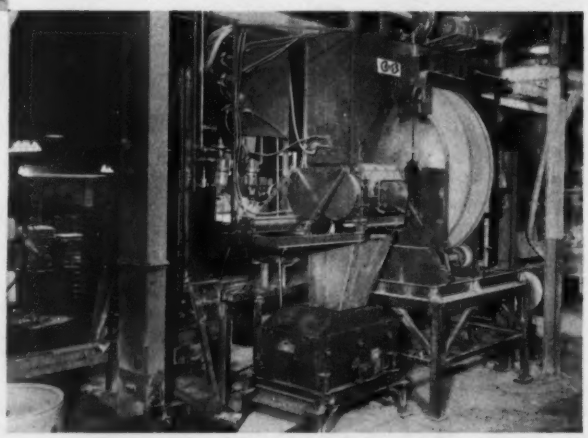

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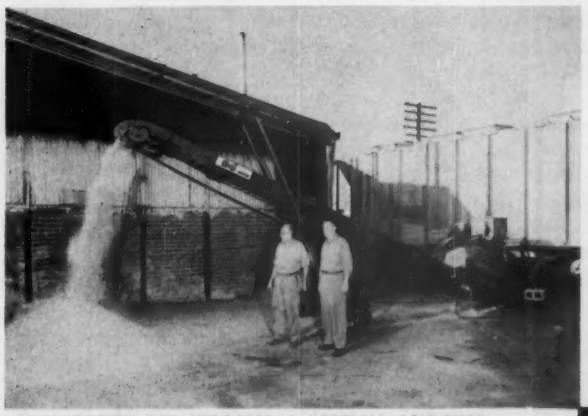

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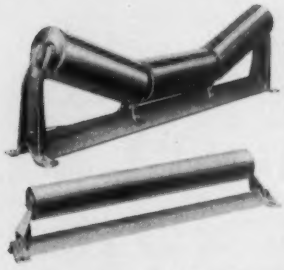

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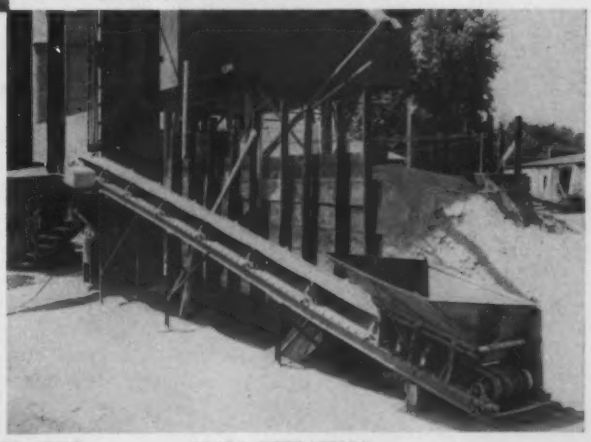

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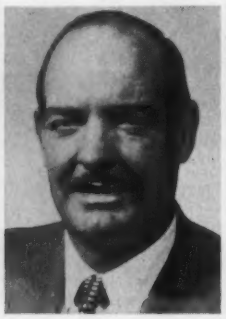

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E. Claude Jeter has been named general manufacturing manager of Ford Motor Co.'s Engine & Foundry Div., Dearborn, Mich., succeeding **Robert Stevenson,** now general manager, Transmission & Chassis Div. **H. C. Grant** takes over Mr. Jeter's former duties as manufacturing manager of foundries. **William E. Goudey,** Dearborn Iron Foundry production manager, replaces Mr. Grant as manager, Dearborn Iron & Specialty Foundries.

Robert J. Murphy has been appointed foundry superintendent, LFM Mfg. Co., subsidiary of Rockwell Mfg. Co., Pittsburgh. He was assistant foundry superintendent. **Joseph S. Turner** has been made manager of production control and purchasing and continues as director of purchases.

C. S. Keller has been named manufacturing manager of Chrysler Corp.'s casting plant in Kokomo, Ind. Since 1958 he has held that position at the company's American Foundry plant in Indianapolis.

Edward N. Harris has been elected vice president of sales, Bohn Aluminum & Brass Corp., Detroit. He has been with Bohn since 1953 in various sales and manufacturing capacities, most recently as plant manager in South Haven, Mich.

Emil J. Koepsell has been named special foundry sales and service representative, Nordberg Mfg. Co., Milwaukee. **William S. Flinchbaugh,** formerly with foundries in the east, succeeds Mr. Koepsell as foundry and pattern shop superintendent.

J. S. Smart Jr., general sales manager, American Smelting & Refining Co., New York, has been elected 1961 president of the Metallurgical Society, American Institute of Mining, Metallurgical, and Petroleum Engineers. He was a director of the Metallurgical Society representing the Institute of Metals Div. for three years preceding his installation as president of the society.

Roger D. Jones has been named chairman of the board of directors, U. S. Smelting Furnace Co., Belleville, Ill. He succeeds the late **Arthur Jones,** who held the post from the company's formation in 1918 until his death last November at the age of 86. Other officers named were **Richard W. Gass,** president, and **Melvin L. Bauer,** secretary and treasurer.

Russell F. Gotha has been named manager of the Stewart Die Casting Div., Stewart-Warner Corp., Bridgeport, Conn., succeeding **Albert J. Booth,** who has been transfered to the Chicago plant as assistant to the general manager of the division. Mr. Gotha has been chief engineer of the Chicago diecasting plant since 1959.

Jonathan Smith has been named vice president of sales for Sunbeam Equipment Corp., Meadville, Pa., maker of industrial heat treat furnaces.

Mahlon E. Wood, for the last four years assistant automotive market manager for Reynolds Metals Co., Richmond, Va., has been appointed market development engineer for American Zinc Institute, New York.

James R. McClurken Jr. has been named assistant plant manager at the Pottstown, Pa., plant, Doehler-Jarvis Div., National Lead Co. Formerly superintendent of the aluminum division, he is succeeded in that post by **P. William Marshall,** who has been superintendent of the zinc division. **Warren H. Guldin,** former time study engineer, has been named general foreman of the zinc division.

A. Spencer Danes, sales manager, has been elected secretary, Sawbrook Steel Castings Co., Lockland, Ohio. **Harold S. Mercier,** vice president-sales, Tool Steel Gear & Pinion Co., a company affiliate, and **Gail L. Stroppel,** works manager of Sawbrook, have been elected directors.

Leonard C. Barr has been elected president, Eutectic Welding Alloys Corp., Flushing, N. Y. He was a founder of Gregory Industries, Lorain, O., and remains a director.

Circle 730, Page 39→

CHIP MELTING–

Another economical application for induction melting.

WATCH AM

98% or more of the charge is converted to molten metal in AM Induction Melting furnaces. This high recovery rate, together with negligible alloy losses and simple temperature control, produces quality metal at a low cost from chips, borings, turnings and other scrap material.

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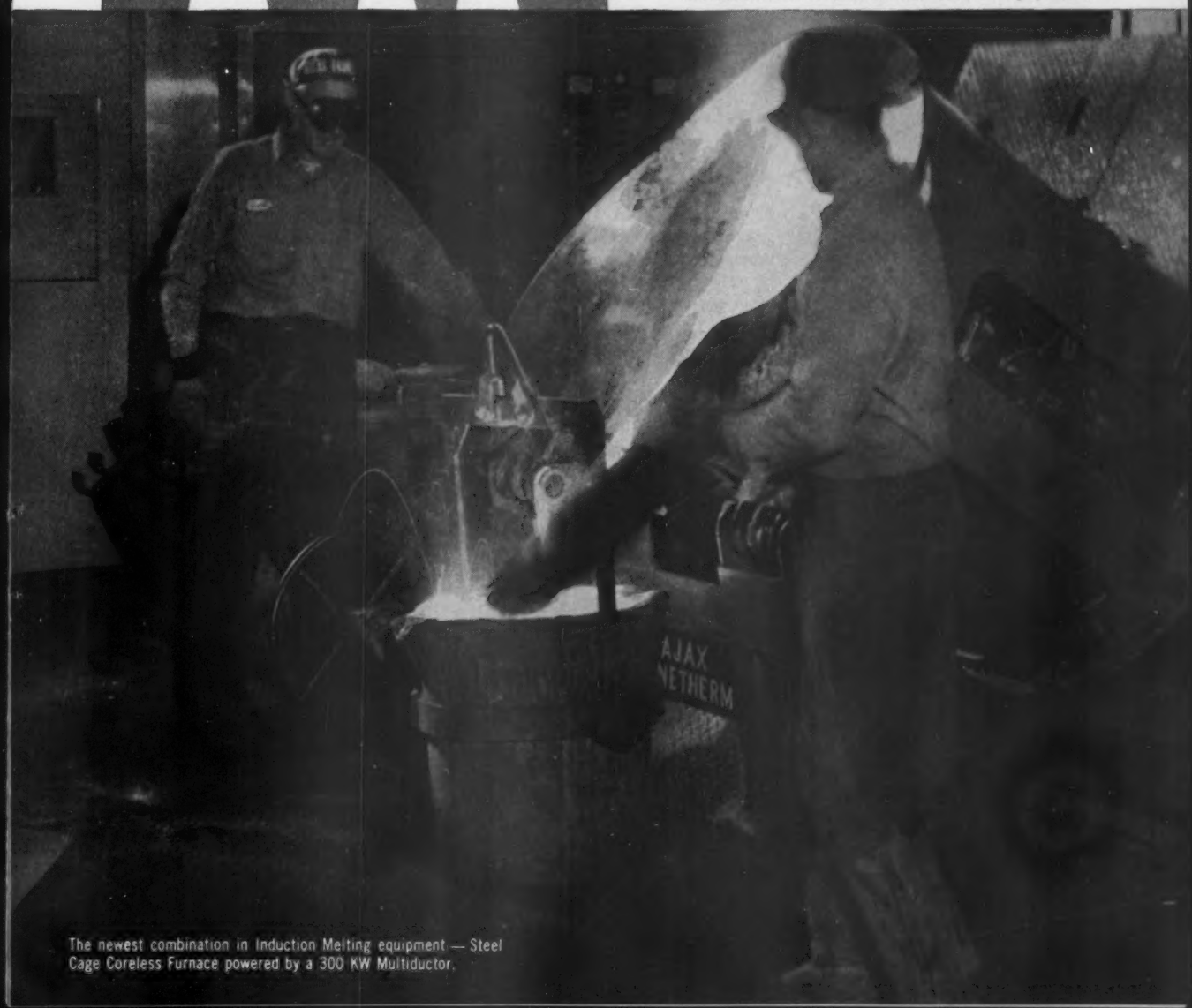

The newest combination in Induction Melting equipment — Steel Cage Coreless Furnace powered by a 300 KW Multiductor.

JAMES H. SMITH
. . . changes at Central Foundry Div.

ELMER E. BRAUN

FRANK P. HACKER
. . . national sales mgr.

ANTON DORFMUELLER JR.
. . . becomes division mgr.

CHARLES D. ZIEL
. . . Roessing Bronze v. p.

Rene D. Wasserman, who founded Eutectic 21 years ago, has been elected board chairman.

Elmer E. Braun, since 1956 works manager, Central Foundry Div., General Motors Corp., has been appointed general manager of the division, succeeding **James H. Smith,** who has retired, as reported in the March issue. Mr. Braun joined the company's Saginaw Malleable plant in 1933, became manager of the Danville, Ill., plant, divisional manufacturing manager, and later production manager. Mr. Smith headed the Central Foundry Div. since it was formed in 1946. He was first employed by Buick Motor Co. in 1915, later transferring to Saginaw Products Div., and to Saginaw Malleable Iron Div. in 1921.

Robert L. Williams has been elected vice president of the marketing division, Lester B. Knight & Associates, Chicago. Mr. Williams formerly headed his own consulting firm, which has been consolidated with the Knight company.

Frank P. Hacker has been named national sales manager of Calamari Co. of America, Div. of DePrato Mfg. Co., Addison, Ill. He joined the company last year when it was formed to manufacture and distribute the low-frequency induction furnaces of Calamari & Co., Milan, Italy.

Vincent D. Bates, formerly assistant to the president, Oberdorfer Foundries Inc., Syracuse, N. Y., has been appointed factory manager. He has been with the company for ten years.

J. P. Casalis Jr. has been appointed St. Louis district manager for Air Reduction Sales Co., New York. He succeeds **W. M. Holley,** who has resigned to become an Airco distributor for the St. Louis area.

C. W. Vokac has been appointed manager of Whiting Corp.'s new Metallurgical Equipment Div., Harvey, Ill., and manager of the division's electric furnace group. Other groups in the division, and their managers, are: Cupolas and accessories, **C. McGlone;** ladles and pulverizers, **R. A. Muhleman;** and metallurgical consulting service, under direction of **W. R. Jaeschke.**

Anton Dorfmueller Jr. has been appointed manager of Federal Foundry Supply Div., Archer-Daniels-Midland Co., Cleveland. With the company since 1955, he has served as specialty products manager, eastern sales manager, general sales manager, and recently as assistant manager of the division.

Charles D. Ziel, former sales manager, has been named vice president, Roessing Bronze Co., Pittsburgh. He joined the company in 1949.

O. B. J. Fraser, since 1947 assistant manager of the Development and Research Div., International Nickel Co., New York, has retired. He joined the company in 1917 as metallurgical engineer at the Bayonne, N. J., works. Mr. Fraser will engage in consultation in the fields of chemistry and metallurgy and can be contacted at 32 West 40th St., New York 18.

Thomas E. Moffitt, since 1957 president of Hooker Chemical Corp., New York, has become board chairman. **F. Leonard Bryant,** who

ROBERT L. WILLIAMS
. . . marketing div. v. p.

R. A. MUHLEMAN

C. McGLONE

C. W. VOKAC
. . . appointments at Whiting Corp.

W. R. JAESCHKE

BELT LIFE TRIPLED WITH 3M ABRASIVE

Union Brass and Metal Mfg. Co., St. Paul, Minn., switched to "Tri-M-ite" Resinbond Cloth Belts for grinding brass plumbing castings prior to plating. The results were remarkable. Belt life was boosted 3 times; a finer scratch pattern was achieved to speed final buffing and plating operations; and overall abrasive costs were reduced 10%!

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"3M" AND "TRI-M-ITE" ARE REGISTERED TRADEMARKS OF 3M CO., ST. PAUL 6, MINN.

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...WHERE RESEARCH IS THE KEY TO TOMORROW

3M

CARL A. KOERNER

CHARLES E. DRURY

. . . Central Fdy. Div. appointments

W. A. MEDDICK

SHELDON K. TOWSON JR.

. . . Elwell-Parker executives

DR. J. A. CROOKSTON

. . . research director

has been executive vice president, succeeds him as president. **Thomas F. Willers,** formerly a vice president, becomes executive vice president.

Carl A. Koerner has been appointed divisional works manager, and **Charles E. Drury,** divisional director of sales and engineering, Central Foundry Div., General Motors Corp. Mr. Koerner previously was manager of the division's Defiance, Ohio, plant, and more recently divisional director of sales and engineering. Mr. Drury, formerly divisional director of reliability, has served as factory manager of the Saginaw Malleable plant, and as manager at Danville, Ill.

G. F. Kolle, formerly with Ajax-Magnethermic Corp., Trenton, N. J., has joined Inductotherm Linemelt Corp., Delanco, N. J., as assistant general manager and treasurer.

Larry Nelson has been appointed chief engineer, W. W. Sly Mfg. Co., Cleveland, in charge of engineering, design and development. He will also supervise the customer service department.

Sheldon K. Towson Jr., vice president-general manager, Elwell-Parker Electric Co., Cleveland, has been elected president of the company, succeeding **W. A. Meddick,** who becomes chairman of the board. Mr. Towson joined Elwell-Parker in 1956 as assistant to the president. Mr. Meddick, a 25-year veteran, became president in 1958.

Alexander C. Andrew has been appointed superintendent in charge of gray iron operations, Springfield Foundry Co., Indian Orchard, Mass.

Ralph W. Fink, since 1958 controller of Spincraft Inc., Milwaukee, has been elected a vice president of the company.

Graham G. Barton has been named vice president, Michigan Oven Co., Detroit. He joined the company in 1950. **Jerry E. Gibson,** chief estimator, replaces Mr. Barton as engineering sales representative in the Michigan area.

C. P. Vogel has been named vice president in charge of sales, and **R. W. Olsen,** vice president in charge of production, Alloy Metal Abrasive Co., Ann Arbor, Mich. **W. R. Penrice** becomes Chicago district sales manager, and **Joseph F. Sack,** Chicago sales representative.

Dr. James A. Crookston, manager of new product development, has been appointed director of research, A. P. Green Fire Brick Co., Mexico, Mo. He has been with the company since 1955.

Walter R. Saunders has been appointed north midwest regional manager, Yale Materials Handling Div., Yale & Towne Mfg. Co., Philadelphia, with his headquarters at 304 N. Elmhurst Rd., Prospect Heights, Ill. Mr. Saunders has spent 20 years in the industrial lift truck field.

Robert A. Gordon has been appointed manager of district sales, Link-Belt Co., Chicago. With the company since 1946, he has been on special assignment at the executive office since 1958.

Woodrow D. East has been appointed vice president-manufacturing, Pittsburgh Metals Purifying Co., Mars, Pa. Mr. East, an indus-

LARRY NELSON

. . . chief engineer

GRAHAM G. BARTON

JERRY E. GIBSON

. . . promotions at Michigan Oven Co.

WALTER R. SAUNDERS

. . . Yale regional mgr.

ROBERT A. GORDON

. . . district sales mgr.

O-1 MIL-T-5677A Inconel W AMS 5334 SAE 60304 QQ-N-288 SUPER 6 AISI 347 ACI-HK Inconel 303(Se) SAE 440C PWA 653 17-4-PH AMS 5360 AISI 410 S-590 H-13 A286 D-2 N-155 4340 AISI 316 304 M-10 AISI 430 S-816 17-4-PH 60304L A-2 WASPALLOY SUPER 6 MIL-S-862A SAE 60310 ACI CA-15 AMS 5376 MIL-S-854 H-11 ASTROLOY WalMet X SAE 60304L NiResist 1A AMS 5378 MIL-T-7880 SAE 70310 QQW 423 70316 S-590 WI-52 M-10 AISI 303 SUPER 3 WI-52 BR-4 PWA 651 AM 355 AMS 5353 AISI 321 S-816 H-21

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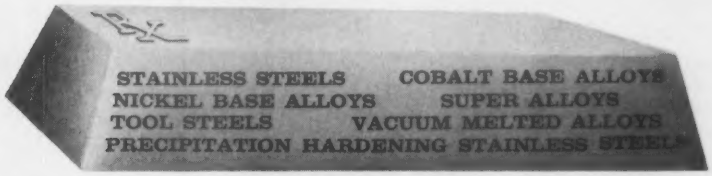

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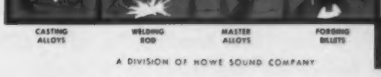
If you're casting stainless, or planning to, you'll want the FREE bulletin, "Heat Treatment and Properties of Cast Hardenable Stainless Steels". WRITE TODAY!



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DEARBORN 2, MICH.
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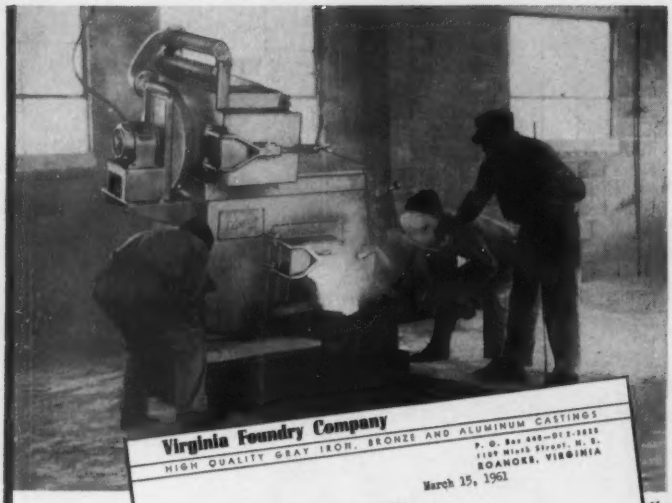
A DIVISION OF HOWE SOUND COMPANY



Virginia Foundry Company
HIGH QUALITY GRAY IRON, BRONZE AND ALUMINUM CASTINGS
P. O. Box 668—611 E. 23rd Street, N. E.
ROANOKE, VIRGINIA

March 15, 1961

International Foundry Supply Company
Box 1053
Reading, Pennsylvania

Mr. Rex Harrison

Dear Mr. Harrison;

Enclosed please find our signed report of the melting tests performed at installation of our Revecon 320/500 Brass and Bronze Furnace.

Over a period of a year and a half of operating our Revecon, we have established melting costs of under 1¢ per pound when taking into consideration melt loss, fuel, flux, and refractory maintenance and replacement. This confirms the test data of this report.

Through the use of our Revecon Furnace, we have greatly improved our competative position in the brass and bronze foundry business to the point where we have just completed building our new non-ferrous foundry to handle this expanding line.

As you know, we are a jobbing foundry serving the valve, machinery, and electrical industries where Quality is a Must. Since we purchased our Revecon Furnace our melt quality has greatly improved with overall lower cost.

In conclusion, I would like to state that the modern foundry demands up to date Revecon Furnaces in their melting department and I would also like to compliment your company on its service after sales, which has been most beneficial to us.

Yours very truly,

VIRGINIA FOUNDRY COMPANY

PAUL L. HUFFMAN
PRESIDENT

PROOF

OF

REVECON

Brass Melting Superiority

REVECON FURNACES — TECHNICAL REPORT — No. RR 7

Plant: VIRGINIA FOUNDRY COMPANY ROANOKE, VIRGINIA

Visited by R Harrison Date Oct 26-27, '59 Contact Mr. Paul Huffman

Furnace No. 0 99071OON Type 320/500 Fuel #2 Fuel oil General Condition Good

Approximate Life of Lining at Time of Test Zero weeks / Lining

Condition of Lining — As New

Oil Pressure 2.5 psi

Brass Flux - Harwark Bronzecover ILL

REPORT ON MELTING TESTS — Date

No.	Metal From	Metal Type	Time Charged	Time Ready	Time Poured	Fuel Oil Ft./Gals. Start	Fuel Oil Ft./Gals. End	Fuel Oil Ft./Gals. Amount	Charged Lbs.	Poured Lbs.	Loss Lbs.	% Loss	Temp./Pyro. Pour Temp. etc.
Oct 26													
1	Ingot	#115	8:30	9:00	9:10	80 gallons			500				2200° F
2	"		9:30	9:55	10:00	Fuel oil test			400				2200° F
3	Coins		10:14	10:45	10:55	used for these			507				2200° F
4	"		11:10	11:38	11:45	heats including			507				2200° F
5	"		12:10	12:37	12:45	pre-heat and			500	492	8	1.6	2200° F
6	Ingot Coins		1:10	1:30	1:40	holding.			250				2200° F
						Melt Loss		1.44 @ $25.25/100 pounds			$ .362/100	pounds	
						Fuel		1.5 gal/100 @ $.16/gal			.210/100	"	
						Flux		3 pound/100 @ $.22/pound			.110/100	"	
						Refractories		$550.00 for 300,000 pounds			.183/100	"	
						TOTAL COST					$ .865/100	pounds	
						TOTAL COST TO MELT THIS POUND					$ .00865	per pound	

Witnessed by: PAUL HUFFMAN, PRESIDENT

LET US SHOW YOU HOW to enjoy benefits like these in your Foundry! Non-crucible REVECON Furnaces are available in sizes for every foundry need: 50 lbs. to 30 ton capacity. REVECON offers the greatest possible flexibility when changing metals. Oil, gas or coke fired.

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INTERNATIONAL FOUNDRY SUPPLY CO.

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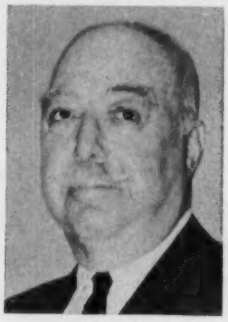
Canadian Representative: DREW BROWN LTD., 5410 Ferrier St., Montreal 9

trial engineer, joined the firm last fall to supervise and co-ordinate the company's new production facilities. He formerly managed the Houston plant of Englander Co., Houston, Tex.

Robert Roy has been appointed sales manager of spectrochemical instruments, Baird-Atomic Inc., Cambridge, Mass. He joined the company in 1955 and for the last five years has been sales engineer in the Detroit area.

A. H. Ciaglia has been appointed chief technical engineer of the eastern division, G. E. Smith Inc.,



A. H. CIAGLIA
. . . chief tech. engineer

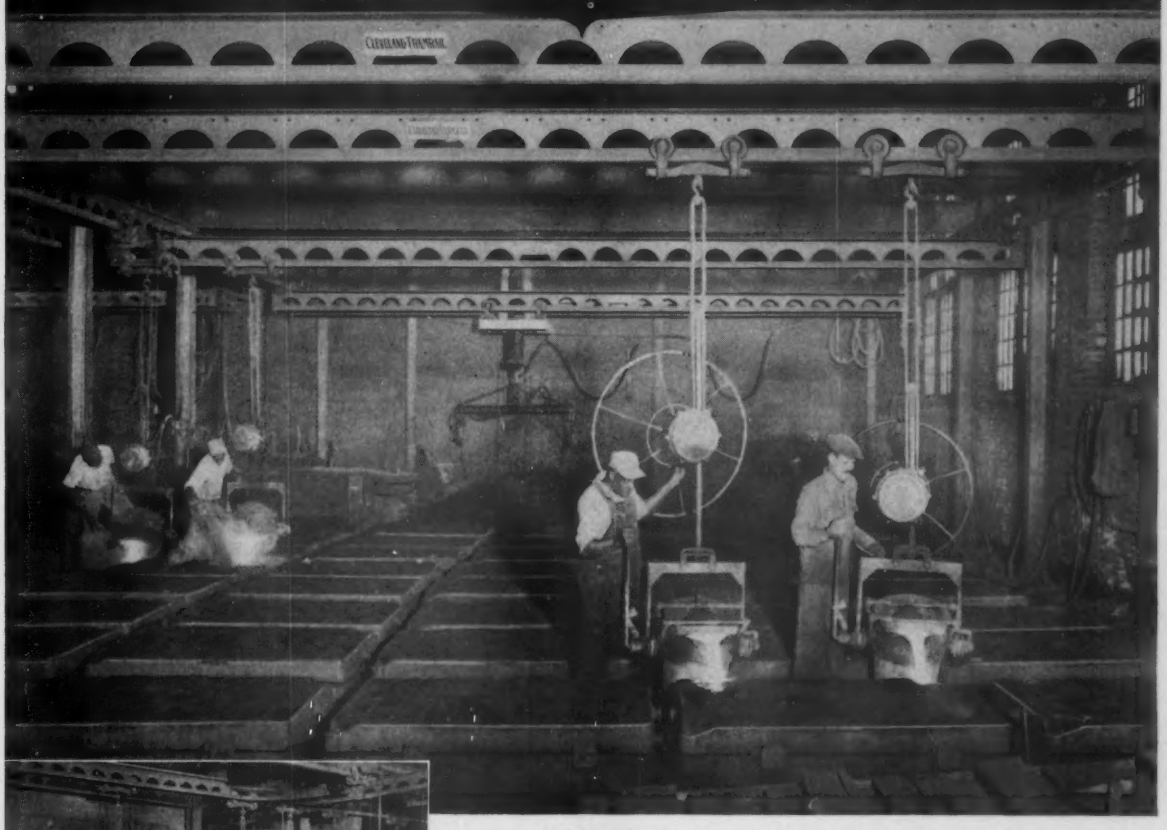
Pittsburgh. With the company since 1954, Mr. Ciaglia's duties have included technical sales as well as research and development.

Lewis C. Black, vice president, Bucyrus-Erie Co., South Milwaukee, Wis., has been elected president of the Power Crane & Shovel Association. Other officers include **Hugh B. Halloran**, crane sales manager, Manitowoc Engineering Corp., Manitowoc, Wis., vice president; and **Herbert S. Blake Jr.** and **Donald V. Reed**, both of Organization Service Corp., New York, secretary and treasurer, respectively.

Harold W. Buus has been appointed general manager, Stearns Magnetic Products Div., Indiana General Corp., Milwaukee, Wis. Mr. Buus has served Stearns in various engineering and sales capacities since 1941 and most recently was director of research and development. He succeeds **Frank S. Greenwald**, who has been named manager of product development for the parent corporation. **Wil-**

MAINTENANCE PRACTICALLY NO PROBLEM AFTER

14 YEARS OF CONTINUOUS SERVICE



Single girder hand-propelled cranes are used for pouring. Two molds are usually poured from one crane at a time.

Hot metal is delivered directly from cupola to molds via the overhead Cleveland Tramrail track system and transfer cranes. The ladles have 500 lbs. capacity.

Wickham Piano Plate Co., Springfield, Ohio, produces piano plates for the finest pianos built in America. They are made of special alloy iron, have intricate ribbing and very thin sections which require highly skilled craftsmanship to make.

For more than 14 years, overhead Cleveland Tramrail equipment has been of tremendous help in all phases of the work. It not only has brought about time savings but has been an important factor in reducing spoilage.

The entire foundry is provided with Cleveland Tramrail. Actually, through all steps of production, from molds to shipping floor, the piano plates are on the Tramrail system, except for brief periods when they are removed for finishing and machining operations.

The equipment has proven extremely successful in the Wickham plant. Despite the many years of service, practically no maintenance is required.

4 reasons why Wickham Piano Plate Co. is happy with Cleveland Tramrail

1. Helpful advice given by local Cleveland Tramrail engineer-distributor.
2. Ease of equipment erection.
3. Smooth rolling action of Cleveland Tramrail cranes and carriers.
4. Extremely low maintenance costs.

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Overhead Materials Handling Equipment

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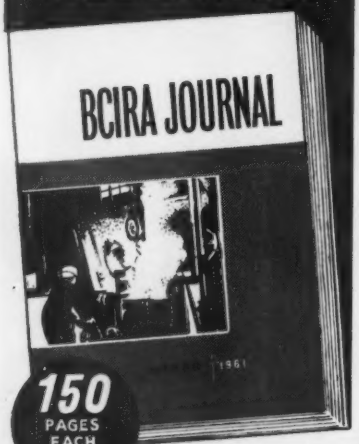

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For More Information Circle 748, Page 39

liam G. Luedtke, formerly chief engineer, was named director of engineering.

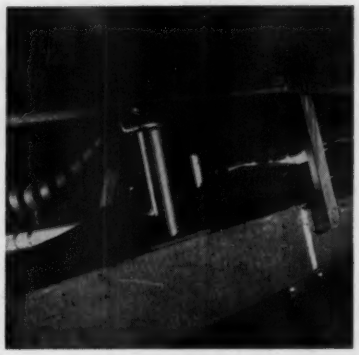
William A. Kerr has been elected a vice president of Bausch & Lomb Inc., Rochester, N. Y. In addition to his present duties as manager of the military products division, including Herron Optical Co., a Los Angeles subsidiary of Bausch & Lomb, Mr. Kerr also has become B & L management representative for Applied Research Laboratories, Glendale, Calif., another Bausch & Lomb subsidiary.

E. C. Chapman, since 1956 manager of eastern sales, Caterpillar Tractor Co., Peoria, Ill., has been named assistant manager of the company's sales development department. The northwest and southwest sales divisions are now the western division, managed by J. A. Justeson. W. E. McCoy, formerly southwest division manager, has succeeded Mr. Chapman as eastern division manager.

E. C. CHAPMAN
. . . assistant dept. mgr.

T. E. Donohue, formerly general manager, Cleco Pneumatic Tool Co. of Canada Ltd., has been reassigned as sales manager, West Coast Div., Cleco Air Tool Co., a subsidiary of Reed Roller Bit Co., Houston. For the last two years he headed sales operations for Cleco throughout Canada. Haakon Johnsen will succeed Mr. Donohue in the Canadian post. He previously served as special salesman for the organization.

Robert C. Stokes has been named eastern sales manager, Specialloy Inc., Chicago, with headquarters in Philadelphia. Since 1957 he has



JOY Limberoller® idlers outlast steel idlers ten to one in foundry operations

Conventional steel idlers have four bearings under the belt where they can clog up with foundry sand and "freeze," eventually causing ripped belts. Joy Limberoller belt conveyor idlers have just two bearings, one at either end, supporting a neoprene-covered steel wire cable. Neoprene discs are molded to the cable, and the swedged shank ends of the cable fit into bearings. The entire unit revolves on its own axis in these end-mounted bearings.

Spilled foundry sand can't possibly get into the bearings because they are up out of the dirt. The bearings may be of the permanently lubricated type so that inspection and greasing are eliminated entirely. Many foundries that have standardized on Joy Limberollers have removed them from their maintenance records. You can make a trial installation simply by putting Limberollers on your present conveyors . . . conversion is quick and easy. Get the complete story by writing for bulletin 2746-13.

JOY

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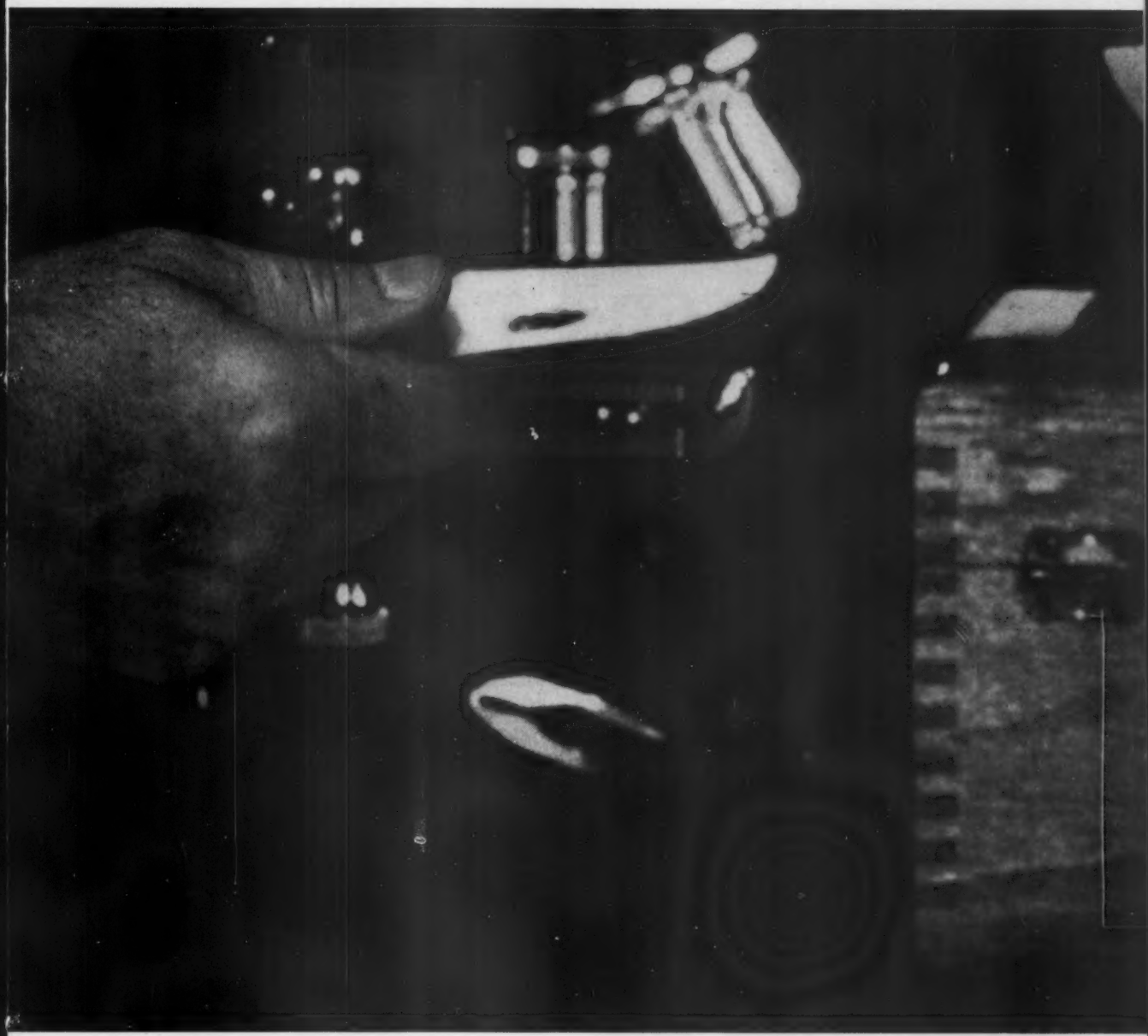
For More Information Circle 749, Page 39

coke...tested and retested... to give you better melting in your cupola



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Every day in every Semet-Solvay coke plant, continuous tests are conducted to determine and control product quality and uniformity: Chemical tests, pyrometric tests, physical tests. Shatter tests, specific gravity tests, porosity tests.

Result: Coke that is low in ash and sulphur, high in carbon, strong and uniform . . . to super-heat and melt your metals in the hottest, fastest, most efficient cupola operation you can possibly have.

Get the whole story by writing today for our just-off-the-press brochure, "The Advantages of Using Semet-Solvay Foundry Coke."

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SEMET-SOLVAY DIVISION
Dept. 611-F, 40 Rector Street,
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For More Information Circle 739, Page 39

Microporosities in castings can be filled, and the castings made pressure-tight, if you impregnate them with:

RAM PAK

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KIRK WHITE CHEMICAL CO.

OCONOMOWOC, WISCONSIN

For More Information Circle 740, Page 39

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GES 95 A

HIGH POWERED ELECTRIC ANGLE GRINDER 1.6 hp.

Swiss precision-made, the LESTO GES 95A is the **strongest** angle grinder on the market. Peak performance—sanding, grinding, cutting—even under the toughest conditions.

For complete information, see your dealer or write:

VICTOR J. KRIEG, INC.

P. O. BOX 7
1 DEPOT PLAZA
MAMARONECK, N. Y.

been vice president-general manager, Crown Non-Ferrous Foundry Inc., Chester, Pa. **Irving Nathan,** eastern resident vice president, will assume marketing responsibilities for Specialloy in June. His Connecticut office will be transferred to Chicago at the time, and his former duties will be transferred to Mr. Stokes and the Philadelphia sales unit.

Marion S. Richardson has been named sales manager, industrial furnaces, Industrial Heating Dept., General Electric Co., Shelbyville, Ind. He previously was sales engineer for Hevi-Duty Furnace Co. in Philadelphia.

Frank W. Trost has been named district manager of the Philadelphia territory, the Chas. Taylor Sons Co.,

FRANK W. TROST
. . . Taylor district mgr.

Cincinnati, subsidiary of National Lead Co., New York. His headquarters will be in the company's district sales office, Haddonfield, N. J.

Henry A. Bednarski has been appointed sales engineer in the furnace products division, Basic Inc., Cleveland, and will serve in Philadelphia. He was assistant manager, basic sales, for Harbison-Walker Refractories Co., Pittsburgh.

James I. Smith has been named head of sales administration, Lord Chemical & Equipment Div., Wheelabrator Corp., York, Pa. **Dean E. Keener** heads customer service and relations. **Dean Stitely** will head the laboratory of the division. **Norman J. Roy** has joined the division to head research and development programs for compounds and media. **Forrest G. Clements,** chief engineer in charge of

For More Information Circle 741, Page 39

NOW FOR BIG SHELL CORES... BEARDSLEY & PIPER SF-10A CORMATIC®

Up to 90 big hollow shell cores every hour! That's the productivity of Beardsley & Piper's new SF-10A Cormatic, based on a single-cavity maximum size core box. (Multiple cavity core boxes of course increase productivity proportionately.)

Designed as a big brother to the highly successful SF-6BA, the new SF-10A Cormatic accommodates core boxes up to 30" in height, 25" in length and 800 lbs. in weight. Completely automatic, the SF-10A is equipped with both pneumatic and electric controls. An operator need only push one button to actuate the cycle. The machine clamps, blows, locks, drains, and cures cores automatically. The operator then strips the core and reactuates the cycle.

The SF-10A has a hi-lo direct gas-fired manifold with 210,000 BTU output—and either natural, manufactured or bottled gas can be used. Core box temperature is thermostatically controlled to within plus or minus five degrees. Denser, more uniform cores are always obtainable. Blow pressure can be varied from extreme lows to full line pressure. The sand magazine, of 150 lb. capacity, travels on a specially constructed track and is clamped by a pneumatic powered latch. The unit is also equipped with a 300 lb. shell sand storage hopper which automatically feeds sand into the magazine.

NO ADDITIONAL MANPOWER WITH CORMATIC

The completely automatic SF-10A provides important manpower savings for your core room. One man can operate more than one machine, thus the outstanding productivity of multiple units can be yours with no additional man-hour cost . . . another example of B&P engineered equipment to cut your costs.

Your B&P representative has complete information on this outstanding unit. He will be happy to show you how your core room can best be served by the productive, cost-cutting Cormatic. Contact him today—be more competitive tomorrow.

For More Information Circle 742, Page 39

ANOTHER BETTER METHOD FROM BEARDSLEY & PIPER

RESEARCH

BEARDSLEY & PIPER
Div. of Pettibone Mulliken Corp.
2424 N. Cicero Ave., Chicago 39, Ill.

FEMA

equipment development and research, has moved to new quarters at the Red Lion, Pa., plant. The new division, formerly known as Lord Chemical Corp., was acquired by Wheelabrator last year.

J. J. Forst, formerly purchasing manager, metals and electricals, Olin Mathieson Corp., New York, has been named assistant product manager of the aluminum pig, ingot and billet product department of the company's Metals Div.

Albert G. Eschrich has been appointed technical sales representative for Foseco Inc., of Cleveland. He will represent the company's product line in southern Illinois, Missouri, and eastern Kansas. Mr. Eschrich formerly was with Mosley Electronics, St. Louis.

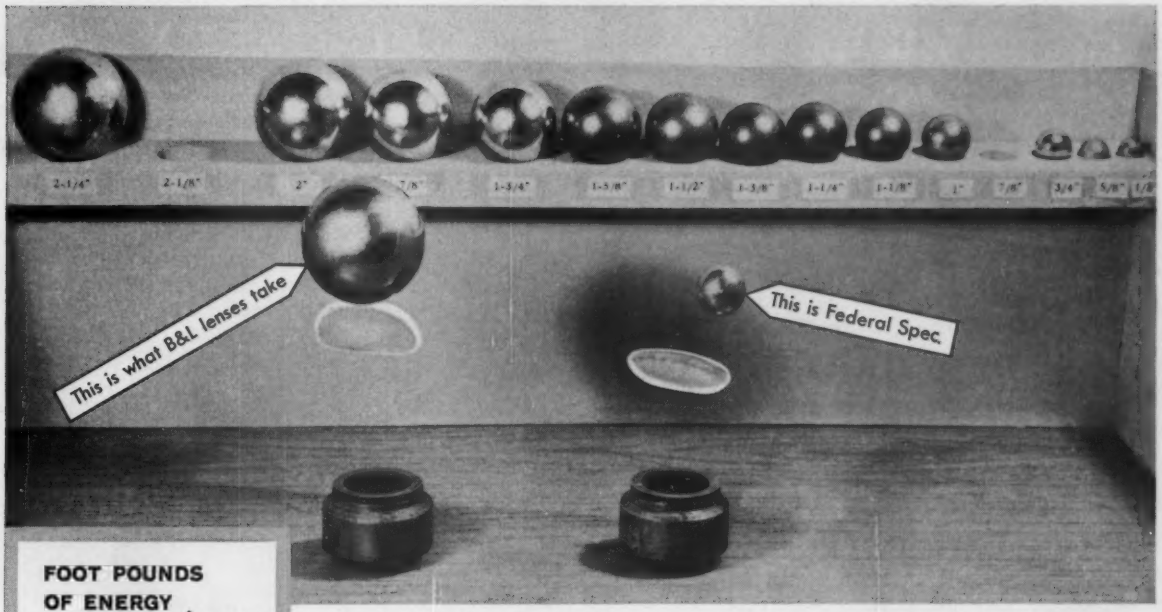
ALBERT G. ESCHRICH
. . . Foseco sales

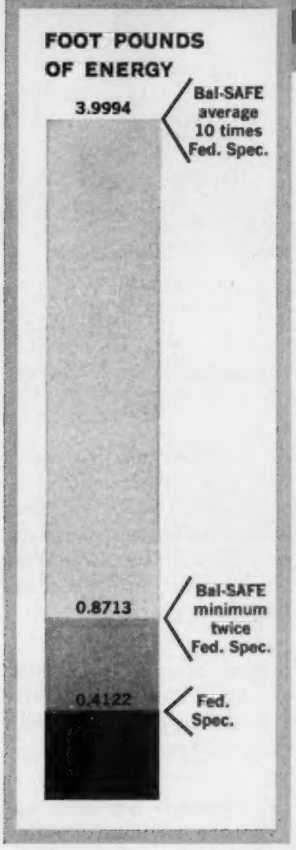
N. F. Moody, formerly Philadelphia district manager, has been named eastern regional sales manager, Air Reduction Sales Co. He succeeds **A. S. Blodget,** who has become vice president of the midwestern region.

P. J. Stefik Jr. has been appointed district sales manager in the Portland, Oreg., area for Union Carbide Metals Co., Div. of Union Carbide Corp., New York. He was sales representative for the Portland area.

Edward C. Bayer has been appointed technical director, Holcroft & Co., Detroit. Graduated from the University of Detroit, he joined the company in 1946.

Reuben W. Pelto, since 1953 a divisional sales manager for the Ready-Power Co., Detroit, has been





GET *at least* TWICE THE EYE SAFETY YOU PAY FOR

Bausch & Lomb Bal-SAFE lenses twice as tough as Federal Standard

In the picture above, you see two bouncing steel balls stopped in mid-air by the high speed camera. The balls were dropped simultaneously from a height of more than 4 feet. Federal Standards Bureau specification for safety lens impact resistance requires exactly this test, using the ⅞" diameter steel ball you see on the right. Truth is, B&L Bal-SAFE lenses withstand impact from 2 to 10 times greater than Federal specification.

By B&L standards, every lens must withstand the shock of a 1⅛" diameter steel ball, or twice the impact of the ⅞" ball. This extra safety is engineered through a special B&L lens toughening process that adds *not a penny of extra cost to you.*

Ask your safety man: "how much eye protection are we now getting—and are we getting all we might bargain for?"

A representative from one of the 314 suppliers of B&L Safety Products in U.S. and Canada will show you the many pluses in protection awaiting you all through the B&L lines—and vision screening for safer, more productive use of eyes on the job by means of the famous B&L Industrial Ortho-Rater.

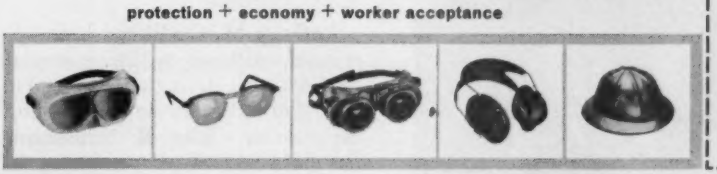
Why shouldn't superior eye protection be an achievement of Bausch & Lomb! World leaders in ophthalmic research, with the only glass plant in the Western Hemisphere devoted exclusively to manufacture of optical glass, Bausch & Lomb leads in all forms of eyesight conservation.

Perhaps of special interest to you right now is a new portfolio of facts available for all persons concerned about eye safety. Send coupon for your free copy.

Protection-PLUS Safety Products

protection + economy + worker acceptance

BAUSCH & LOMB



BAUSCH & LOMB INCORPORATED
99917 Lomb Park, Rochester 2, N. Y.

Please send SAFETY PORTFOLIO "Helpful Hints for the Man Responsible for Safety."

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ADDRESS .....

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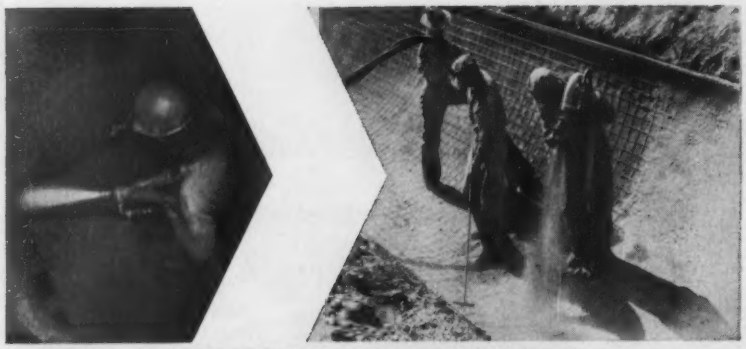
For More Information Circle 744, Page 39



THE PNEUMATIC GUN . . .
applies adhesive strength of sand-cement layer up to 10" thick in a continuous application!

Force sprays into every crack, crevice and corner for permanent strength in building, repairing or waterproofing concrete construction. Effective for sandblasting, when used without sand-cement mix. Completely dependable, both in operation and results. Has wide application in Steel Industries, Foundries, Refineries, Refractories, all Construction areas.

for details, write to
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1518 WALNUT STREET, ALLENTOWN, PA.
AREA CODE 215, HEmlock 3-4168

For More Information Circle 745, Page 39

Control Foundry Chilling with
CHILL
KOOLHEAD
NAILS
CHILL NAILS and SPIDERS
Choose any style chill nail from jumbo to stubby; slim, medium, or horse nail blade; blunt, pointed, straight or 90° bent. Some types available in Stainless, Brass, Aluminum; Copper coated to order. Spider Chills, jumbo or horse nail legs—double or single. Available in various sizes and types; also made to your individual specifications.
Write for detailed descriptions and prices.
STANDARD
Since 1872
HORSE NAIL CORP
NEW BRIGHTON PA
Other Products
PINS
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Stanho
PRODUCTS
KEYS

For More Information Circle 746, Page 39

made vice president and manager of truck unit sales. **Norbert K. Hall**, with the company since 1950, has been made vice president and manager of air conditioning.

Stuart Tyler has been appointed district representative for Williams Bucket Div., Wellman Engineering Co., Cleveland. He will cover western New York and Pennsylvania, Ohio, and West Virginia area. Mr. Tyler recently was with Wepco Equipment Co., Cleveland.

C. A. Thomas has been appointed midwest sales engineer, Taccone

C. A. THOMAS
. . . joins Taccone Corp.

Corp., North East, Pa. He was with Herman Pneumatic Machine Co., Pittsburgh.

Eugene J. McKenna has been named technical representative in the general New York city and northern New Jersey territories for the Newton-New Haven Co., West Haven. He has been in the diecasting field for many years.

C. Richard Schmitt has joined Duff-Norton Co., Pittsburgh, as New York state sales representative, with headquarters in Syracuse, N. Y.

Alex V. Durovich has been appointed abrasive engineer, Sterling Grinding Wheel Co., Tiffin, Ohio, for the Philadelphia, New York, and Baltimore areas. He has had 16 years of experience in the grinding wheel industry.

Anthony M. Cirelli has been appointed customer service manager, Dollin Corp., Irvington, N. J. He was lead inspector in the casting department. **John R. Schuchardt** has been named sales engineer in

CAST METALS IN ENGINEERING EDUCATION . .

UNIVERSITY OF CALIFORNIA

Prof. E. Paul DeGarmo, left, directs Cast Metals study. Course is taught by Associate Prof. James S. Campbell, right. View in foundry shows sand testing equipment, core oven dump box, glueing press for shell molding core blowers.

Amazing Growth

The University of California was founded in 1868 and has grown more rapidly than any similar institution in the United States. Today, on its eight campuses, full-time enrollment exceeds 48,000 students. This student body and its 12,000 faculty members and employees make it one of the largest universities in the world.

Regarded by educational authorities as one of the most distinguished universities in America, it usually is included among the first five in the quality of faculty and of facilities for instruction and research. The University of California faculty represents the second largest membership in the National Academy of Sciences and the largest number who have won Guggenheim Fellowships. Eight faculty members are Nobel prize winners. In addition, the University was ranked second by the American Council on Education in the number of distinguished departments which it maintains.

Campus in The Foothills

Oldest of the eight campuses in the statewide system, the Berkeley campus covers more than 900 acres in the foothills of the East Shore of San Francisco Bay. From almost every part of the campus there is a spectacular view over the Bay and the city of San Francisco, the neighboring plains and mountains, the Pacific Ocean, and the famous Golden Gate.

The University has an endowment of approximately $100,000,000, which ranks it near the top among American universities.

Expansion Under Way

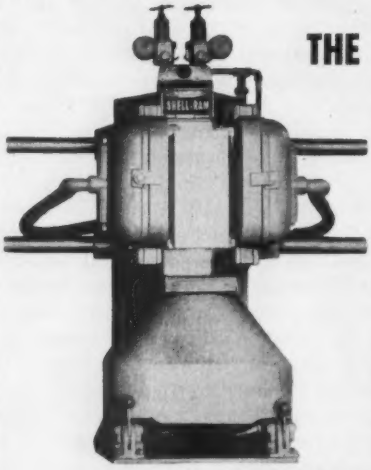
California became affiliated with the FEF in 1955. The present cast metals laboratory is to be expanded when the new Metals Processing building is completed. In addition to the courses offered in foundry engineering, the cast metals receive significant attention in the manufacturing processes and engineering materials courses. Fifteen outstanding California students have been awarded FEF scholarships.

FOUNDRY EDUCATIONAL FOUNDATION, Terminal Tower, Cleveland, Ohio

The Foundry Educational Foundation does not pay for this advertising. This advertisement has been prepared and the space contributed by FOUNDRY magazine in support of FEF's constructive program for foundry industry progress through education.

ROCK 'n' ROLL ? ?
OH, NO ! !

NOT WHEN YOU MAKE SHELL CORES WITH



THE "SHELL-RAM"®

The core box remains stationary—is invested from the bottom—drained and cured. Cycle timers are standard Equipment.

—No Lost Motion—

The "Shell-Ram" produces a dense core, intricate in shape such as a valve or similar cores at a high rate of production. Also shell molds with impressions on both sides. Hand operated and automated models. The "Shell-Ram" is gas fired with radiant heat type burners.

For further information call or write

A. C. CHRIS COMPANY

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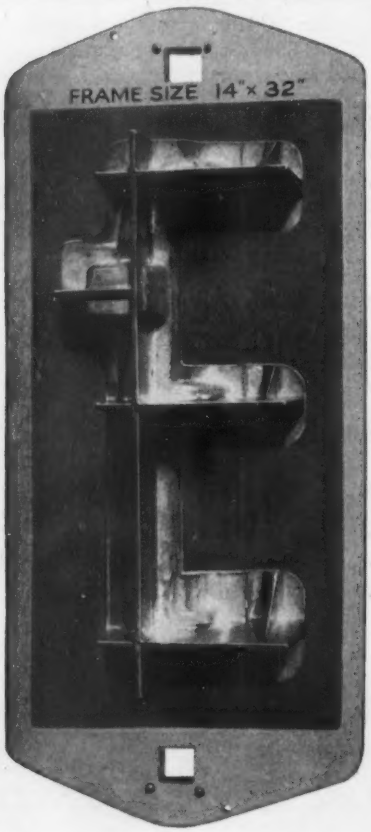
For More Information Circle 802, Page 39



Let's talk profits!
Let's talk increased production!
Let's talk about . . .

TAMASTONE

PATTERN COMPOUND

The Drier pattern at left is for air intake diesel manifold made from an original master pattern. *Only one skrinkage!* Material is aluminum. Pattern was used for 50 Driers. Only 3 hours labor and 35 pounds of TAMASTONE were required. Up to 1,000 castings have been made from a plate of this type!

No special skill needed to increase production 400% or more! . . . WRITE . . .

TAMMS INDUSTRIES CO.
228 N. LaSalle Street
Chicago 1, Illinois

ROBERT W. MILLER
. . . assistant sales mgr.

New England, succeeding **T. R. Foley**, who has been assigned to metropolitan New York.

Robert W. Miller has been appointed assistant sales manager of the Pershing Rd., plant, Link-Belt Co., Chicago, succeeding **Albert W. Holmes**, who has retired after 38 years of service. Mr. Miller joined the company's Philadelphia plant in 1940.

Robert P. Lawrence has been appointed field engineer, nickel sales, Alloy Metal Products Inc., Davenport, Iowa. He was with Nickel Div., National Lead Co., with headquarters in Longansport, Ind.

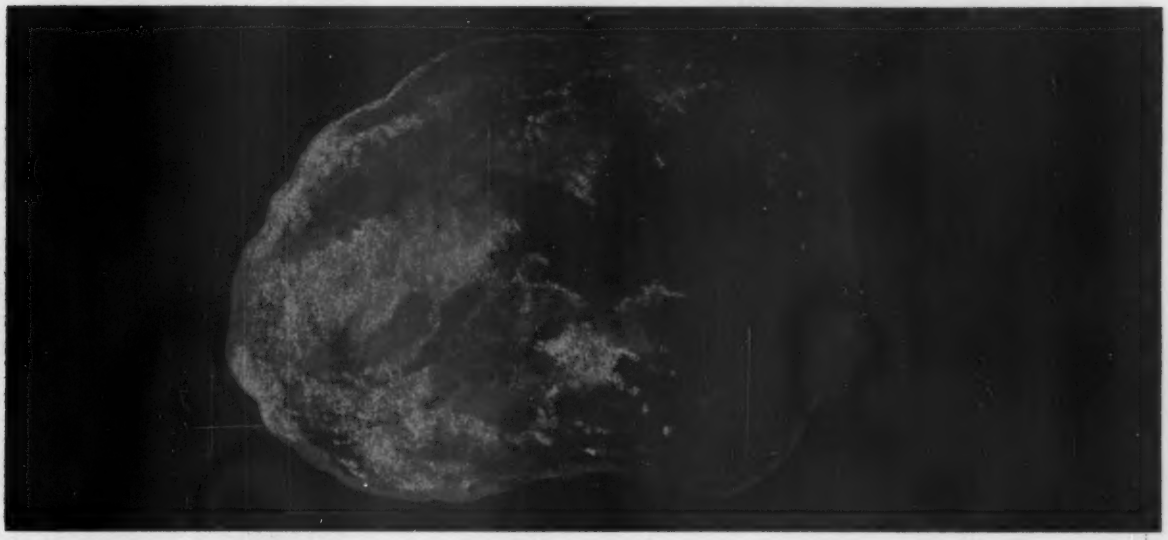
Donald Sanberg has resigned as administrative director, Malleable Founders Society, Cleveland, to join American Society of Lubricating Engineers, Chicago, as executive secretary.

Charles R. Miller, formerly with Palmer-Bee Co., Detroit, has joined Anchor Steel & Conveyor Co., Dearborn, Mich., as sales engineer in Ohio and metropolitan Pittsburgh.

CHARLES R. MILLER
. . . Anchor Steel sales

Clean as a whistle!

Here is a grain of used foundry sand, the way it appears after being cleaned by the KFW reclamation process. (120 magnification)



NOW! The newest, most efficient, low-cost method of sand reclamation provides a positive answer to an age-old foundry problem!

From KFW Corporation, Detroit, Michigan . . . a new and revolutionary method for cleaning and reclaiming foundry sand! This patented process economically cleans a used foundry sand in such a manner that it may be readily reused indefinitely. The cleaning is accomplished at a very low cost, and with a minimum of equipment. No other equipment like it. KFW units are presently in operation in large industrial concerns with fantastic success. Complete information and technical data are available at no charge.

KFW CORPORATION

CONSERVATION & RECLAMATION OF FOUNDRY SAND
PATENTED METHODS & APPARATUS

General Office: SUITE 2130 DIME BANK BLDG., DETROIT 26, MICHIGAN WOodward 2-9155

For More Information Circle 750, Page 39

"The Moulders' Friend" .....

ONE-MAN SAND CONDITIONER MIXES TWO TONS OF SAND IN ONE MINUTE!

This simple, compact machine does the work of several men better and cheaper.

The rotary wire brush thoroughly mixes and aerates the sand. The Moulders' Friend sand conditioner travels everywhere under its own power. It mixes, wets and screens the sand thoroughly and economically.

Every foundry with sand heaps on the floor needs The Moulders' Friend Sand Conditioner. Call or write for free information.

"The Moulders' Friend" Dallas City, Illinois

For More Information Circle 736, Page 39

"Sometimes you get a punch line for an ad when you least expect it, as when a foundryman says,

SUPERFLUX SAVES ME BUCKS!

"Very much to the point.

"We are shipping our LADLE-FLUX-SF-100 to more ductile iron makers every month, and we are making new friends with our special Refractories."

SUPERFLUX®

Briquetted Cupola Flux

SUPERFLUX MFG. CO.

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HICKMAN, WILLIAMS & CO. Philadelphia New York Cleveland Pittsburgh

SCOTT BRIQUETTED PRODUCTS Welland, Ont.

OBITUARY

George Walther Sr., 85, president and founder of Dayton Steel Foundry Co., Dayton, Ohio, died April 10. He and his brother, the late Jacob Walther, founded the company in 1905.

Basil N. Greenlaw, 63, vice president in charge of operations at the Lancaster, Pa., and Zanesville, Ohio, plants, Burnham Corp., Irvington, N. J., died from injuries received in an explosion at the Zanesville plant on March 3.

John B. Frielingsdorf, 64, president, Banner Iron Works, St. Louis, died March 13, while vacationing in Nassau, the Bahamas. A son of one of the founders of Banner Iron Works, Mr. Frielingsdorf had been with the company all of his adult life, and was president for the last 12 years.

Ernest E. Thum, 76, director of editorial services for American Society for Metals, Novelty, Ohio, and editor-in-chief of *Metal Progress*, its magazine, died April 10, while vacationing in Coranada Beach, Calif. Mr. Thum was the first editor of *Metal Progress* when it was founded in 1930. He organized and edited the *Book of Stainless Steels*, and other technical publications.

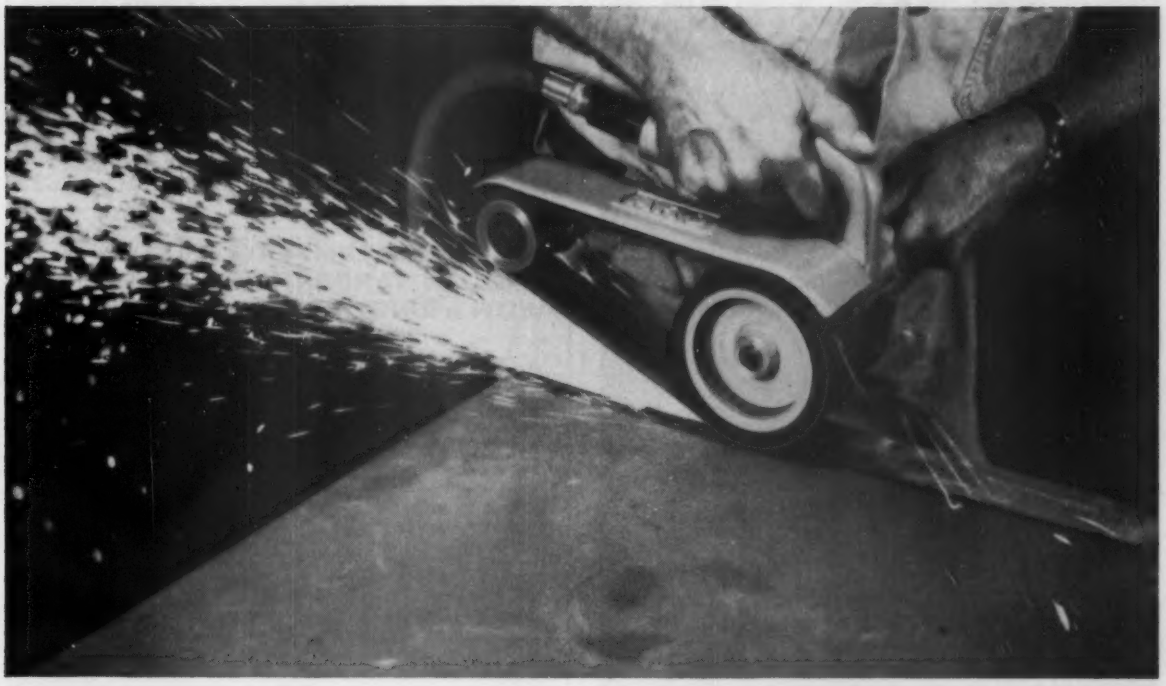
A. Y. Gregory, 70, former president, Whitehead Bros. Co., New York, died Mar. 6. He retired in 1958 because of illness, after over 50 years with the company. He had previously been sales manager, and vice president.

Everett C. Meyers, plant superintendent, Ford Meter Box Co., Wabash, Ind., died Mar. 22. Mr. Meyers had been with the company about 25 years.

William T. Welch, 70, chairman of the board, Ajax Flexible Coupling Co., Westfield, N. Y., died March 12. He founded the company with his father, Dr. C. E. Welch, in 1920.

TOTALLY NEW AIR TOOL

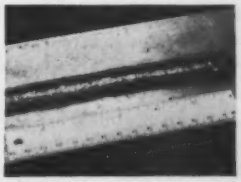
Hogs, Blends, Finishes Metal Faster!



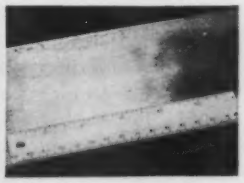
ARO Portable Belt Grinder

You're looking at a new ARO Belt Grinder in action. In this all-new production tool, Aro has combined the backstand idler principle of abrasive grinding with *portability* and *power* to remove metal faster. Live action of the coated abrasive belt running at high speed over slotted, resilient rubber contact wheel sets the abrasive grains "on edge" to give more bite. The metal is actually *sheared* off! Action is smooth and true—no chattering, bumping or bouncing. And you can rough grind and finish in one operation, because the abrasive belt method doesn't leave gouges or swirls in the work. Free belt stropping of corners and radii is easy, too. Beat high grinding costs with new Aro Belt Grinders. Job test one. Ask your Aro Distributor.

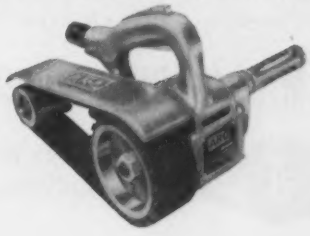
Cuts Metal like Butter!



1 Take a rough 6" weld like this. Put a powerful Aro Belt Grinder on the job, and take the grind out of grinding! Full 2 H.P. air motor running at 6000 R.P.M. produces 7000 S.F.P.M. Belt speed—you hog and finish in one operation.



2 Here's the result just 1¼ minutes later, using a 24-grit belt. This is typical of the outstanding performance you can expect from the new portable Aro Belt Grinder—only tool of its kind—unbeatable for grinding performance.



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AIR TOOLS

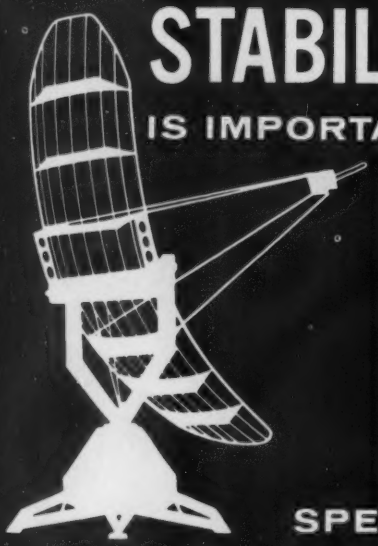
AIR HOISTS • AUTOMATION TOOLS
ULTRASONIC CONTROLS

THE ARO EQUIPMENT CORPORATION
Bryan, Ohio

Aro of California, 3141 S. Grand Avenue, Los Angeles 7, California; Aro Equipment of Canada Ltd., Rexdale (Toronto), Ontario
Offices in all Principal Cities

For More Information Circle 754, Page 39

WHERE
DIMENSIONAL
STABILITY
IS IMPORTANT...



SPECIFY
PRECEDENT 71
ALUMINUM CASTING ALLOYS

DIMENSIONALLY STABLE TO 0.00001" PER INCH

Parts in computing devices, aircraft or missile guidance systems, and electronic equipment must be dimensionally stable, sometimes to a few millionths of an inch per inch. Two factors interfere with such dimensional stability: (1) locked-up stresses and (2) growth. While there are many approaches to the solution of this problem, most involve a lot of time and trouble, but contribute little to stability of parts.

The most positive solution is the use of Precedent 71 aluminum casting alloys which may be stress relieved by heat treatment at 700°F for four hours followed by cooling in still air. This stress relieving heat treatment is applied to the raw casting and no subsequent treatment is required. After stress relieving at 700°F, Precedent 71 A and B alloys are completely dimensionally stable to 0.00001" per inch.

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J

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AURORA, ILLINOIS

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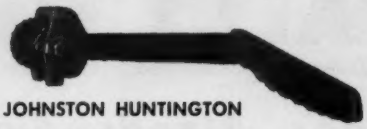

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NEW

LONGER LASTING
WHEEL DRESSER & CUTTERS

- COMFORTABLE AND SAFE
- EXTRA HIGH CARBON MILLED CUTTERS
- SIX SETS OF BEARINGS

Write for free dresser guide

MACHINE PRODUCTS CORP.
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FROM HARD LUMPS TO VELVETY
SMOOTH SAND IN 15 SECONDS
WITH A RINGLIFT SAND CONDITIONER

Picks up all sand from floor, screens, cools and aerates, removes all scrap, powerful magnetic separator, adds moisture, mixes and deposits fluffy sand on floor in windrows. Operated by remote control. Most economical conditioner to operate and maintain. Send for literature.

STATES ENGINEERING
CORPORATION
245 E. Murray St.
Fort Wayne, Indiana

For More Information Circle 792, Page 39

The Cupola
and Its Operation

A comprehensive text on cupola operation for the metallurgist, foundryman and student of foundry technology . . . . . .

The 35 chapters are grouped into the following sections: Operations, Equipment, Materials, Principles related to Operation.

Latest developments, such as hot blast, basic lining for nodular iron, and emission control are covered. Chapters such as those on refractories, principles of combustion, and metallurgy have been greatly augmented or are presented for the first time. More than 50 of the country's outstanding foundrymen have contributed their knowledge and experience to make this book available on cupola operation.

54 tables
300 pages
8 x 11

Price:
$11.00
Postpaid

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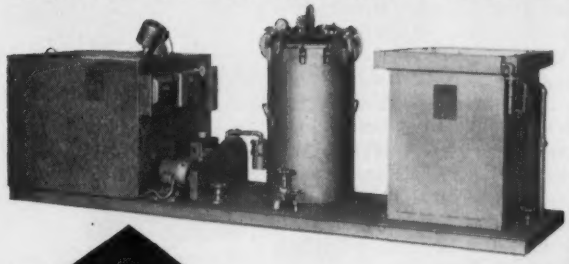
Book Department
1213 W. 3rd St., Cleveland 13, Ohio

For More Information Circle 793, Page 39

CUT REJECTS

OUT OF YOUR COST PICTURE!



MOGUL PACKAGED-UNIT

HIGH VACUUM and PRESSURE IMPREGNATORS

IMPROVE PRODUCT QUALITY

MOGUL means dependable, thorough impregnating with Mogul cast seal or any other impregnating material including polyesters and phenolic resins.

MOGUL, because of extremely high vacuum, removes air and moisture for positive penetration of impregnant into parts. Following this vacuum action, applied pressure then assures still greater coverage and impregnation.

CHECK THESE MOGUL ADVANTAGES:

- **COMBINATION high vaccum and pressure**
- **VERSATILE sizes and ranges: 2 to 100 cu. ft. as standard models 29" or more vacuum, 100 lbs. pressure**
- **THERMOSTATIC CONTROLS**

PLUS:

READY-ASSEMBLED INSTALLATIONS that save work, time and cost

Just hook up complete packaged unit to your utilities and start operation!

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METALLIZING COMPANY OF AMERICA, INC.
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For More Information Circle 755, Page 39

You get MORE with

MOROC®

the controlled silicate CO_2 binder

MORE SPEED. Curing time ranges from ten seconds to three minutes, depending on type of mold or core.

MORE LABOR SAVING. Cores are ready for use when they come from core box. You eliminate movement to and from ovens, handling of core driers, cementing of halves.

MORE FLEXIBILITY. Fast curing means faster handling of rush orders. There's no need to stockpile cores for future orders. You have the flexibility to meet customer needs on schedule.

MORE PROFIT. With MOROC you can get this extra capacity and flexibility with a smaller investment in equipment than would be required for additional ovens or shell-molding equipment.

MOROC COMES IN FOUR GRADES

MOROC 1. High-strength binder.

MOROC 2. High-strength and good collapsibility.

MOROC 3. High-strength and high collapsibility to meet demands of core-blowing equipment.

MOROC 4. Extra-high collapsibility and good flowability.

Other Diamond Chemicals for the foundry:
Soda Ash (briquettes & granulars) Caustic Soda, Chlorine, Solvents

Write for complete information. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond® Chemicals

For More Information Circle 756, Page 39

FAST, ACCURATE, DEEP READINGS

Marshall Thermocouples Promote Castings Quality!

Marshall Enclosed-Tip Thermocouples assure strong, dense, uniform castings from every nonferrous melt! Tip can be immersed 3 inches to 30 inches or more in depth and stirred to speed pyrometer reading. You get accurate temperature from deep within melt in about 20 seconds! Hot junction tip, armored with enclosing tube of special alloy, withstands scores of immersions before low-cost replacement is necessary. Thermocouple wire can't be contaminated from melt or shortcircuited by slag! Rugged, well-balanced Marshall Thermocouples are convenient to carry and use, simple and economical to operate. Available as Furnace Type (below) in lengths up to 10 feet, for use with Stationary Pyrometer . . . or Ladle Type for use with Portable Pyrometer.

. . . write today for Free Catalog!

L. H. MARSHALL CO. 270 WEST LANE AVE. COLUMBUS 2, OHIO

For More Information Circle 757, Page 39

AT LAST! *Airless Blast Cleaning Equipment All Foundries Can Afford:*

PEENIMPAC

LOWEST in initial cost, operating cost, maintenance cost . . . HIGHEST in return per dollar invested. Supplied assembled and complete with electrical equipment.

3 cu. Ft.	$2,375.00
7 cu. Ft.	3,575.00
12 cu. Ft.	4,975.00
24 cu. Ft.	11,975.00

Also exclusive suppliers Walker PEENIMPAC SHOT & GRIT

WALKER PEENIMPAC MACHINE MFG. DIV.

WALKER PUMP CO., 546 11th ST., BROOKLYN 15, N. Y.

For More Information Circle 758, Page 39

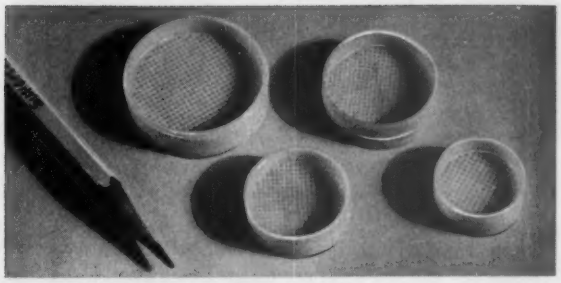
THE PROFITABLE ANSWER . . . . . to rising costs is an effective method and production engineering program

Our professional foundry engineering staff is successfully helping management to increase productivity—increase wages —reduce costs.
We are proud of the results obtained for our foundry clients.
Discussing our services involves no obligation or expense.
Information and references available upon request.

D. C. LATELLA & ASSOCIATES, INC. Consulting Engineers

624 WIDENER BLDG., PHILADELPHIA 7, PA. LOCUST 7-3372

For More Information Circle 759, Page 39



VINCE BRUCE plastic core box vents are noted for these features:

- Newly styled from plastic, they are resistant to acid, oil, and steam.
- They eliminate sticking, slicking, and mudding at venting points.
- Because they have tapered holes, they are self-cleaning, and will not sag.
- They are adaptable to all core boxes and vent plates. (Except shell cores)
- Immediate shipment from stock . . . or can be engineered to your specifications. Write for prices.

Vince Bruce, Inc.

FOUNDRY SUPPLIES & EQUIPMENT
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For More Information Circle 760, Page 39

All of us at

affco

and our Representatives

welcome

FOUNDRYMEN

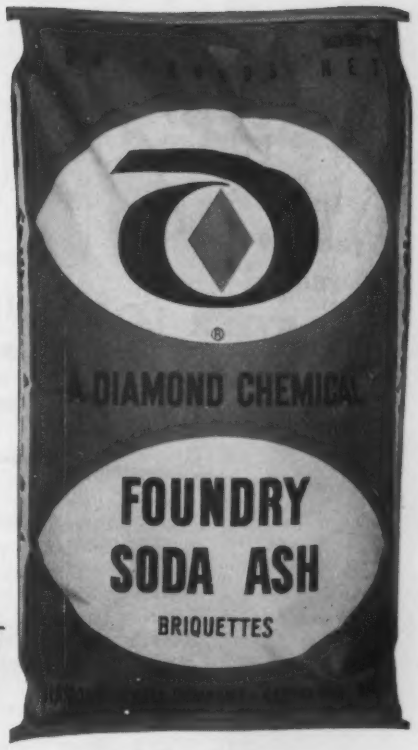
65th Castings Congress Exposition May 8-12, 1961 San Francisco

affco AMERICAN FOUNDRY FLASK CO.
(Div. Cromb & Gagel, Inc.)

Phone VAlentine 1-0800/2745 Southwest Blvd./Kansas City 8, Mo.

For More Information Circle 761, Page 39

NEW



DIAMOND FOUNDRY SODA ASH BRIQUETTES

for fast, efficient, desulphurizing action

No inactive ingredients to add to cost. Pillow shaped for easy handling and fast, efficient desulphurization of molten metal in cupola or ladle. Diamond Foundry Soda Ash Briquettes permit greater use of scrap metal in melting, release entrapped gases and increase fluidity. Tough, moisture-proof 100-lb. bags keep them dry, effective and safer to use.

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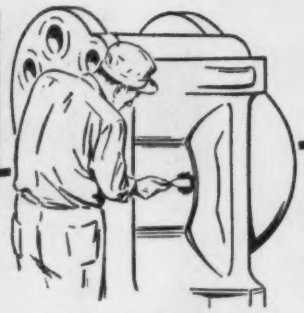
20 N. Wacker Dr. Chicago 6, Ill. STate 2-9550	Oliver Building Pittsburgh 22, Pa. GRant 1-7500	Box 2088 DeSoto Station Memphis, Tenn. BRoadway 2-1736
421 Hanna Bldg. Cleveland 15, Ohio SUperior 1-8683	1006 Main St. Houston 2, Texas FAirfax 3-7329	99 Park Avenue New York 16, N. Y. OXford 7-0440

Other Diamond Chemicals for the foundry: MOROC, silicate CO_2 binder, Caustic Soda, Chlorine, Solvents

Diamond Chemicals

For More Information Circle 762, Page 39



These features mean

BETTER LOOKING CASTINGS

TIGHT, LASTING REPAIRS

When correcting blow or sand holes, surface blemishes, or rough and porous areas in castings, you can depend on Smooth-On Foundry Cements, standard of the industry for more than 63 years. They are easy to apply, harden quickly, stay firmly in place.

THREE DIFFERENT SHADES

With 3 different shades to pick from, you know you can get a close match for your castings.

4AA—Light gray, fine texture
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Rigid quality control means you can be sure that the strength and color of Smooth-On Foundry Cements will not vary from one order to the next. Every lot of Smooth-On cements is laboratory tested and must satisfy tests for setting time, hardness, and color before it is packed for shipment.

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Why not try one or more of these Foundry Cements at our expense? We will be glad to send you a free sample of any of the cements described above if you will write us on your business letterhead. Write today, and see how Smooth-On can improve the appearance of your castings.

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570 Communipaw Ave., Jersey City 4, N. J.

SMOOTH-ON
FOUNDRY CEMENTS

80-399

For More Information Circle 763, Page 39

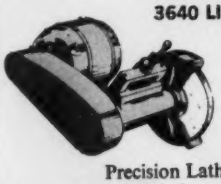
GRIND PROFITS UP!

Use U. S. Electrical Tools

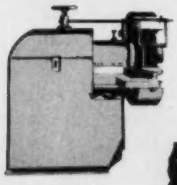
Profits do *go up* when you use U. S. Electrical Tools. You get easier, faster, more economical grinding, buffing and polishing operation. U. S. Electrical portable tools are profit-makers, too.

Ask your nearest distributor.

The United States Electrical Tool Co.
3640 Llewellyn St., Cincinnati 23, Ohio

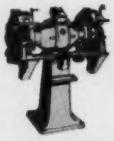


Precision Lathe Grinder

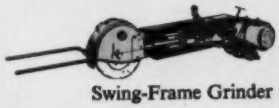


Vari-Speed Single End Grinder

General Purpose Grinder



America's greatest and most complete line



Swing-Frame Grinder

For More Information Circle 764, Page 39

CENTRIFUGALLY CAST
CYLINDER LINERS FOR HIGH PRODUCTION

MODEL MLS

ONE MAN OPERATION
METALLURGICALLY CONTROLLED METAL

Pneumatic control system—Measured molten metal—Timed spin—Automatic spraying—Sturdy construction for continuous operation by unskilled labor.

This is only one of many machines designed for high production of better castings, made centrifugally. Technical advice and mold design service available to all customers.

Write for Illustrated Bulletin No. 161

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For More Information Circle 765, Page 39

SCIENTIFIC
PRESSURE CAST
MATCHPLATES

CHECKED FOR QUALITY
7 WAYS

Inspected at 7 points of manufacture for highest possible matchplate quality . . . Scientific is the only producer using patented new Fortschneider Shift Indicator.

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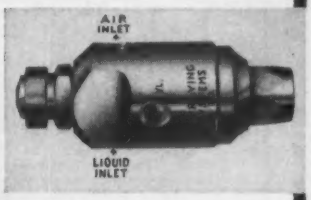
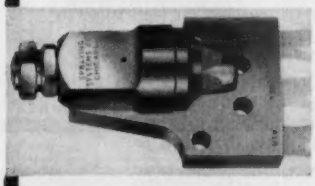
For More Information Circle 766, Page 39

pneumatic atomizing
SPRAY NOZZLES





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AUTOMATION

Spraying Systems offers a complete selection of automatic pneumatic atomizing nozzles for use where controlled intermittent spraying is required. In-built shut-off valve is air operated. Precision built for exact control of spray type and volume. Compact and easily installed. Write for Catalog 24.

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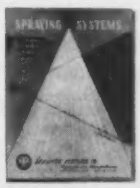
FOR EASIER SPRAY NOZZLE INSTALLATION in any type of system . . . see Catalog 24 for Spraying Systems Adjustable Joints . . . and Bulletin 93 for the NEW Spraying Systems Split-Eyelet Connectors.



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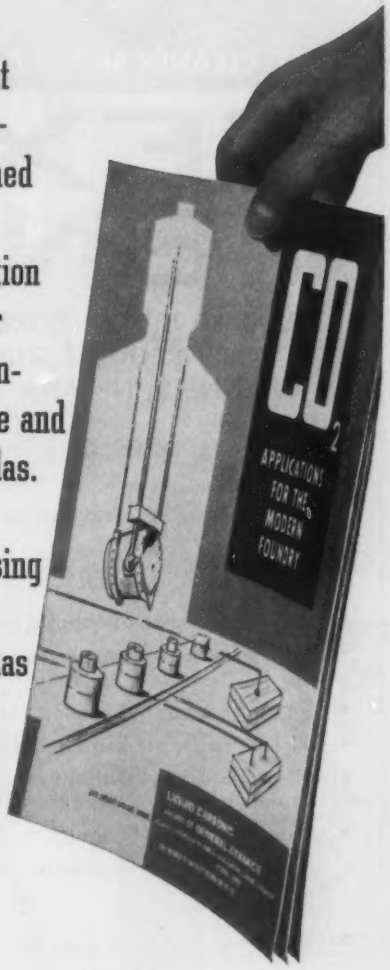
FREE!

It's only eight pages long— But it's jammed with vital information about CO_2 for foundries. Contains new core and binder formulas. Illustrates complete gassing kits. First time anyone has ever offered such a complete manual. Send for yours today.



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Please send me your new, free booklet "CO_2 Applications for the Modern Foundry."

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For More Information Circle 768, Page 39

SAVE TIME AND MONEY

GET CLEANER BETTER CASTINGS

TEX-VENT®

FLEXIBLE TEXTILE CORE VENT FOR IRREGULAR-SHAPED CHANNELS IN SAND CORES

Foundry Tested For Over Three Years

Proven Effectiveness
— Especially For Cold Setting Processes

TEX-VENT IS BETTER . . .

- allows unrestricted use of cold setting processes
- disintegrates completely, even under moderate heat . . . leaves no residue
- no sealing produced around core vent
- will not reduce permeability of core
- reduces porosity in castings . . . shortens finishing time . . . fewer rejects occur
- reduces core baking time
- unaffected by temperature changes while being stored

IN 1/16", 1/8", 1/4", 3/8" AND 1/2" DIAMETERS
Available On Spools For Easy Handling
WRITE FOR DESCRIPTIVE LITERATURE AND SAMPLES

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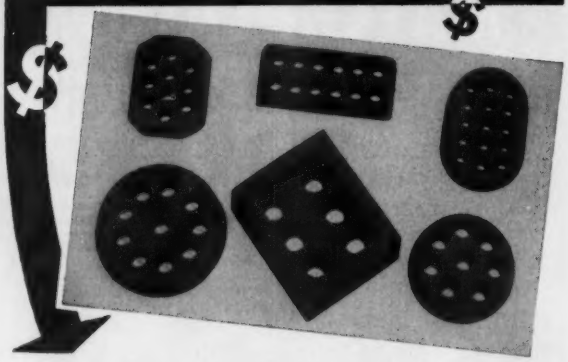
Save Money with RUDOW STRAINER CORES



Custom Made • Will Duplicate Your Sample or Drawing • Unlimited Design Range • High Heat Resistance • Extra Hard • Saves Time—Trouble

RUDOW quality Strainer Cores cut rejects, cut costs, keep castings free of oxides, slag and impurities—simplify gaiting control and metal flow, for greater production. We offer you Free Samples of RUDOW Strainer Cores—made like your sample, or from your drawing. Write today—or phone MAin 6-1163.

SEND FOR FREE BULLETINS, PRICES ETC.

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For More Information Circle 770, Page 39

NCP makes effective

PATTERN LACQUERS

1. Seals pattern to prevent moisture and water absorption.
2. Brushes easily—dries quickly.
3. Does not chip, peel, bubble, or blister, and is flexible.
4. Adds slip, promoting clean parting of pattern from sand.
5. Made in all colors.
6. Time tested material—successfuly used in pattern shops all over the country for over 30 years.

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For More Information Circle 771, Page 39

FOUNDRY CONSULTANTS

APPRAISALS . . . WAGE INCENTIVE PLANS . . . COST SYSTEMS . . . EXECUTIVE CONTROL . . METHODS PRODUCTION CONTROL SYSTEMS . . . PLANT REMODELING . . PLANT DESIGN . . CONTINUOUS SYSTEMS . . . SEMI-CONTINUOUS SYSTEMS . . . PRESENT OPERATION MODERNIZED

EDWIN S. CARMAN, INC.
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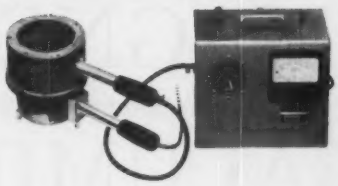
For More Information Circle 769, Page 39

For More Information Circle 772, Page 39

Hydrogen Content Control
REDUCES REJECTS
with One Minute Foundry Test



Rejection of aluminum alloy castings, due to porosity, can be reduced through the use of one or more "HYCON TESTERS" in your foundry. The MEL model 5203 HYCON TESTER uses the "Initial Bubble Principle" to determine hydrogen gas content in molten aluminum alloy to an accuracy as close as ±0.05 ml H_2/100g. Immediate and accurate control is thus available *before* casting. A simple operation requires but a minute. A small amount of molten alloy is ladled into the pre-heated electric crucible and pressure reduced at a controlled rate. When first bubbles break surface, temperature and pressure are noted and referred to a nomogram for precise hydrogen content reading.

A foundryman can make the test quickly and accurately with MEL model 5203 HYCON TESTER.

Meltronics, Inc.
1010 N. Main Street, Elkhart, Indiana
Phone, COngress 4-1116

Write for Complete information.
Manufacturers Representatives solicited

For More Information Circle 773, Page 39

MURPHY PISTOL SPRAYER guaranteed

2922

Forces blackening into pores and pockets of molds. Sprays silica wash, oil, or water equally well. Used also to sand blast, to clean automobile and diesel engines, to spray centrifugal molds. Standard of the foundry field for more than 50 years. Priced from $17.25. Write for quantity discounts.

(Also furnished in a deluxe model with air pressure reducing valve, 20' of air hose, and 5' of suction hose, both of superior quality, oil and acid resisting plastic.)

Ask your foundry supply dealer or —

Write for FREE Data Sheet No. 2922

JAMCO

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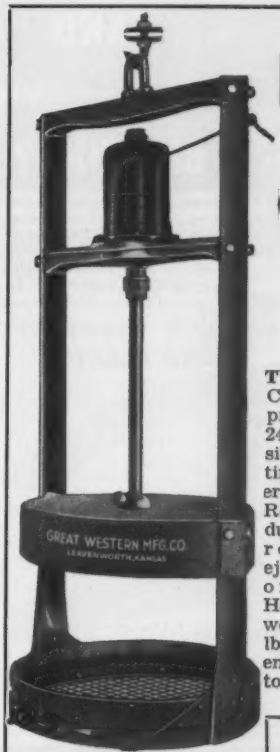
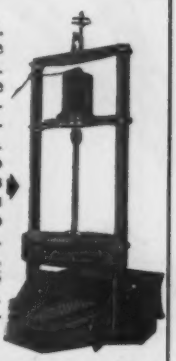


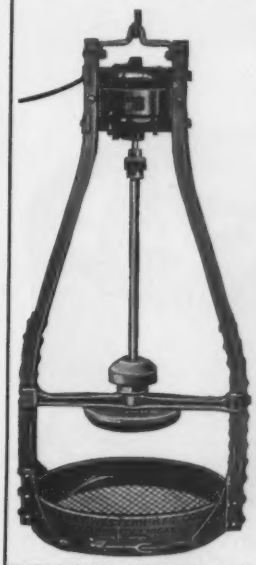
RUGGED SCREEN-ABILITY!
COMBS GYRATORY RIDDLES

"Greatest Name in Motion"

TYPE "CS". Complete price $395.00. 24" square sieve. A continuous operation sieve. Requires no dumping, as refuse is ejected off to one side. Height 4'10", weight 295 lbs, ⅓ H.P. enclosed motor.



TYPE "CR". Complete price $385.00. 24" dia. round sieve. Sifts, fluffs, mixes, aerates sand. Height 4'6", weight 250 lbs., 1/3 H.P. enclosed motor.



TYPE "HL". Price $285.00 complete, less sieves. Laboratory model especially designed for laboratory sand control, fitted with 1/6 H.P. enclosed motor.

PROMPT DELIVERY from your Foundry Supply House

TYPE "V". Price, 20" Sieve, $300.00. Does the work of 10 men. Screens sand, Fine, Medium, and Coarse. 20" dia. sieve with special clamp for 5-second changes. Height 4'6", weight 100 lbs., fully-enclosed 1/6 H.P. motor. Also available in Giant V-5 with 36" sieve for triple capacity . . . Price $545.00.

MAIL THE COUPON NOW!

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Leavenworth, Kansas Phone MU-22291

☐ Send Additional FREE Information

NAME

ADDRESS

CITY STATE

For More Information Circle 775, Page 39

HAVE YOU TRIED **SAND BLASTING?**

SAVE up to 75% on required man hours for rust removal, scale removal, or metal finishing. SAVINGS on your first few jobs can pay for this amazing portable sand blaster that delivers up to 50% more power.

NEW

PORTABLE "SANDY JET" SAND BLASTER

Model B

LOW COST

- Needs no separate blasting room.
- Light weight rugged construction.
- New pistol-grip for easy operation.
- Uses any easily obtainable abrasives.
- Three sizes of interchangeable sand nozzles and air jets, available to suit any job.
- Fast, intense, powerful, cutting action.
- Operates efficiently on 50 to 225 lbs. air pressure.
- Abrasive container holds 60 pounds of sand.

★ 10 day money back trial offer. Complete with face shield, operators' hood and two extra nozzles.

Write for catalog

Order from your distributor or directly from the factory.

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For More Information Circle 776, Page 39

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MAGNESIUM
OR
ALUMINUM

We can supply any requirement. • Nearly 100 of our own patterns . . . or we'll use yours • Prompt Delivery • Phone or write for sizes and prices . . . *and get our bid last!*

MAG-ALCO Foundry

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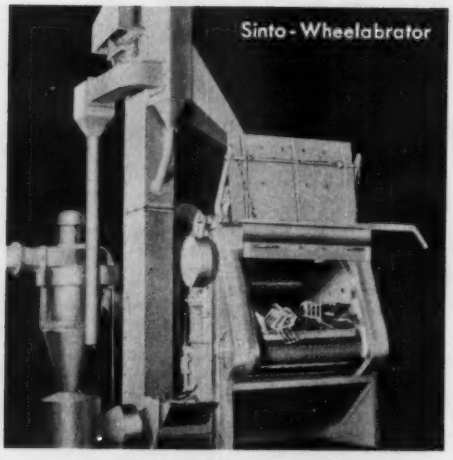
Progressive Foundries Specify **SINTOKOGIO** Equipment

Sinto-Simpson Mix-Muller



Moulding Machines
Sand Preparing Machines
Shot Blasting Machines
Mechanized Foundry Equipment

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Technical cooperation with **Wheelabrator Corp. U.S.A.** and **Simpson International Ltd. U.S.A.**

For More Information Circle 778, Page 39

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Careful balancing makes Penn Buckets self dumping when loaded and self righting when empty. Welded construction prevents "clinging" makes them empty easily and completely.

WRITE TODAY FOR NEW BULLETIN AND DIMENSION SHEET

No. 4-A
Self-Dumping

PENN IRON WORKS, INC.
READING, PENNA.

For More Information Circle 779, Page 39

EMPIRE*

"THAT GOOD" FOUNDRY COKE

DEBARDELEBEN COAL CORPORATION
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Phone: ALpine 1-9135
**Reg. U. S. Pat. Off.*

For More Information Circle 780, Page 39

GREAT LAKES FOUNDRY SAND CO.

SILICA, LAKE, BANK AND MOLDING SANDS . . . JUNIATA BANK SANDS . . . ABC FOUNDRY COKE . . . ALL BONDING MATERIALS, REFRACTORIES & ABRASIVES

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For More Information Circle 781, Page 39

FOUNDRYMEN!!

NOW...A 4 MINUTE GRAY IRON TEST

- Obtain accurate technical data on brittleness and strength as soon as test bar has cooled.
- Test data complies with Federal Specifications QQ-1-652.
- No experience necessary... no need to shield from factory dust.
- Tester is bench type, requires little space. Low in cost and trouble-free.

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Write, wire or phone
for complete details

PASADENA HYDRAULICS INC.
PRESS
1433 Lidcombe, El Monte, California

For More Information Circle 782, Page 39

75,000 FOUNDRYMEN will read the June Post-Convention Issue

Some 75,000 foundrymen (initial copy recipients plus pass-along readers) will read this important issue to find out what went on at the 1961 AFS Castings Congress in San Francisco. This issue will provide a detailed report on the technical sessions and other convention activities. To advertisers, the June Post-Convention issue of FOUNDRY presents an important opportunity to attract the attention of 75,000 metal casting management, engineering and production people. With business conditions on the up-turn and following the Convention, their interest will be at a peak . . . particularly concerning new methods, new materials, new machinery. For further information, contact your FOUNDRY representative.

FOUNDRY A Penton Publication The Business Magazine of Metal Casting

PENTON BUILDING, CLEVELAND 13, OHIO

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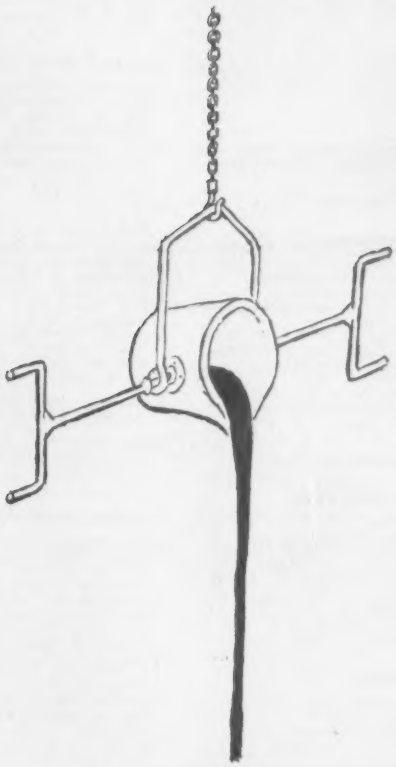

SUPPLEMENT TO

FOUNDRY

MAY, 1961

where-to-buy

FOUNDRY EQUIPMENT, SUPPLIES, MATERIALS, AND SERVICES

Looking for the names of suppliers to the foundry industry? The following pages list the principal types of foundry equipment, materials, services and give names and addresses of companies which can fill your needs.

WHERE-TO-BUY

The following list classifies the foundry equipment, materials and services offered to the industry by the advertisers of FOUNDRY

ABRASIVE (Brick and Files)

Bay State Abrasive Products Co.
Westboro, Mass.
Carborundum Co.
Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co.
1101 W. Monroe
Chicago 7, Ill.
Macklin Co.
Jackson, Mich.
Norton Co.
Worcester 6, Mass.
Peninsular Grinding Wheel Co.
729 Meldrum Ave.
Detroit 7, Mich.
Simonds Abrasive Co.
Tacony & Fraley Sts.
Philadelphia 37, Pa.

ABRASIVE (Metallic) — See SHOT and GRIT (Metallic)

ABRASIVE BELTS

Atlantic Abrasive Products, Inc.
South Braintree 85, Mass.
Behr Manning Co.
Troy, New York
Carborundum Co.
Niagara Falls, N. Y.
Minnesota Mining & Mfg. Co.
900 Fauquier St.
St. Paul, Minn.

ABRASIVE CLOTH and PAPER

Atlantic Abrasive Products, Inc.
South Braintree 85, Mass.
Behr Manning Co.
Troy, New York
Carborundum Co.
Niagara Falls, N. Y.
Minnesota Mining & Mfg. Co.
900 Fauquier St.
St. Paul, Minn.

ABRASIVE GRIT

Macklin Co.
Jackson, Mich.
Norton Co.
Worcester 6, Mass.
Simonds Abrasive Co.
Tacony & Frawley Sts.
Philadelphia 37, Pa.

ABRASIVE WHEELS—See GRINDING WHEELS

ACCELERATORS (Mold and Core Binder)

Reichhold Chemicals, Inc.
525 North Broadway
White Plains, N. Y.

ACETYLENE—See GAS

AERATORS—See SAND PREPARATION EQUIPMENT

AFTERCOOLERS (Compressed Air)

Carrier Conveyor Div.
Chain Belt Co.
211 N. Jackson St.
Louisville 2, Ky.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
James A. Murphy & Co.
Hamilton, Ohio.

AIR CONTROL EQUIPMENT

Bellows Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Texas.
Foxboro Company
Foxboro, Mass.
Hunt Valve Co.
1913 East State St.
Salem, Ohio.
Modern Equipment Co.
Port Washington, Wis.
Valvair Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.

AIRLESS BLAST CLEANING—See BLAST CLEANING EQUIPMENT

ALLOYS—(See type of metal)

ALLOYS (Vacuum Melted)

WaiMet Alloys Co.
5320 Oakman Blvd.
Dearborn 2, Mich.

ALUMINUM and ALUMINUM ALLOYS and INGOTS

Alloys & Chemicals Corp.
4365 Bradley Rd.
Cleveland 9, Ohio.
Aluminum Co. of America
30 Mellon Square
Pittsburgh 19, Pa.
Cleveland Electro Metals Co.
2391 West 38th St.
Cleveland 13, Ohio.
Federated Metals Division
American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.
Wm. F. Jobbins Co.
Aurora, Ill.
Kaiser Aluminum & Sales Inc.
300 Lakeside Dr.
Oakland 12, Calif.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Olin Mathieson Chemical Corp.
400 Park Ave.
New York, N. Y.
Reynolds Metals Co.
Richmond 18, Va.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

ANNEALING—See FURNACES (Heat Treating and Annealing)

ANTI-PIPING COMPOUNDS — See EXOTHERMIC COMPOUNDS

ARGON—See GAS

ASSOCIATIONS

British Cast Iron Research Assoc.
Bordesley Hall Alvechurch
Birmingham, England
Crucible Manufacturers Association
11 W. 42nd St.
New York 36, N. Y.
Foundry Educational Foundation
Terminal Tower Bldg.
Cleveland 13, Ohio.
Society of Die Casting Engineers
19382 James Couzens Highway
Detroit, Mich.

BAND SAWS—See SAWS

BANDS (Snap Flask)

Adams Co.
Dubuque, Iowa.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.

BARS (Steel)

Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.

BEARINGS (Anti-Friction, Roller and Ball)

Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Stephens-Adamson Mfg. Co.
Aurora, Ill.
Timken Roller Bearing Co.
Canton 6, Ohio.

BEARINGS (Sintered Bronze)

United States Graphite Co.
Saginaw, Mich.

BELTING (Conveyor, Elevator, Power Transmission)

B. F. Goodrich Co.
Industrial Div.
Akron, Ohio.
Great Western Mfg. Co.
Leavenworth, Kans.
Imperial Belting Co.
1750 S. Kilbourne
Chicago 23, Ill.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Raybestos-Manhattan Inc.
Manhattan Rubber Division
Passaic, N. J.
United States Rubber Co.
1230 Ave. of Americas
New York 20, N. Y.

BENTONITE—See CLAY (Bonding)

BERYLLIUM COPPER ALLOYS

Beryllium Corp.
Reading, Pa.

BINDERS, CORE and MOLD (Air Setting)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Humble Oil & Refining Co.
P. O. Box 67
River Rouge Sta.
Detroit 18, Mich.
Reichhold Chemicals, Inc.
525 N. Broadway
White Plains, N. Y.
G. E. Smith, Inc.
246 Washington Road
Pittsburgh 16, Pa.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

BINDERS, CORE (Cereal)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Baroid Chemicals Inc.
Sub. National Lead Co.
P. O. Box 1675
Houston 2, Tex.
Corn Products Co.
17 Battery Pl.
New York 4, N. Y.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
General Foods Corp.
1551 Willow St.
Kankakee, Ill.
Robeson Process Co.
P. O. Box 960
Erie, Pa.

BINDERS, CORE and MOLD (Furfuryl Alcohol)

Quaker Oats Co.
Merchandise Mart Plaza
Chicago 54, Ill.

BINDERS, CORE and MOLD (Oil)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Baroid Chemical Inc.
Sub. National Lead Co.
P. O. Box 1675
Houston 2, Tex.
Cities Service Oil Co.
20 N. Wacker Dr.
Chicago 6, Ill.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Hercules Powder Co.
Wilmington 99, Del.
Humble Oil & Refining Co.
P. O. Box 67
River Rouge Sta.
Detroit 18, Mich.
Reichhold Chemicals, Inc.
525 N. Broadway
White Plains, N. Y.
G. E. Smith, Inc.
246 Washington Road
Pittsburgh 16, Pa.
Smith Oil & Refining Co.
1102 Kilburn Ave.
Rockford, Ill.
Smith, Werner G., Inc.
1730 Train Ave.
Cleveland 13, Ohio.
Frederic B. Stevens, Inc.
16th & Vernor Highway
Detroit 16, Mich.
Thiem Products Co.
9800 W. Rogers
Milwaukee 14, Wis.
United Oil Mfg. Co.
Erie, Pa.

BINDERS, CORE and MOLD (Pitch)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Fenn-Rilton Co.
324 W. 23rd St.
New York 11, N. Y.
Frederic B. Stevens, Inc.
16th & Vernor Highway
Detroit 16, Mich.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

BINDERS, CORE and MOLD (Resin)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Durez Plastics Div., Hooker Chemical Corp.
1011 Walck Rd.
North Tonawanda, N. Y.

FREE COPIES

of this section are available for your files. Circle item No. 880 on page 39 or write FOUNDRY, Penton Building, Cleveland 13, Ohio.

B. F. Goodrich Chemical Co.
3135 Euclid Ave.
Cleveland 15, Ohio.
Hercules Powder Co.
Wilmington 99, Del.
Reichhold Chemicals, Inc.
525 N. Broadway
White Plains, N. Y.
Ren Plastics, Inc.
5422 South Cedar St.
Lansing 9, Mich.
Smith, Werner G., Inc.
1730 Train Ave.
Cleveland 13, Ohio.
G. E. Smith, Inc.
246 Washington Road
Pittsburgh 16, Pa.
Union Carbide Plastics Co.
270 Park Ave.
New York 17, N. Y.
United Oil Mfg. Co.
Erie, Pa.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

BINDERS, CORE and MOLD (Sodium Silicate)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Diamond Alkali Co.
300 Union Commerce Bldg.
Cleveland 14, Ohio.
Eastern Clay Products Dept., International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Foundry Rubber Inc.
5200 River Road
Washington 16, D. C.
Philadelphia Quartz Co.
1062 Public Ledger Bldg.
Philadelphia 6, Pa.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
United Oil Mfg. Co.
Erie, Pa.

BINS and GATES (Bulk Materials Storage)

American Bridge Div.
United States Steel Corp.
525 Wm. Penn Place
Pittsburgh 19, Pa.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Newaygo Engineering Co.
Newaygo, Mich.
Nomad Equipment Corp.
3110 West Fond du Lac Ave.
Milwaukee 10, Wis.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Webster Mfg. Co.
Tiffin, Ohio.

BLACKING (Mold, Core)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
G. E. Smith, Inc.
246 Washington Rd.
Pittsburgh 16, Pa.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
United States Graphite Co.
Saginaw, Mich.

BLADES (Shot Blast Equipment)

Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

BLAST CLEANING EQUIPMENT (Airless or Pneumatic)

A. L. C. Co.
Rt. 5, Box 40
Medina, Ohio.
Automation Services
P. O. Box 5554
Detroit 38, Mich.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Sinto Kogio, Ltd.
Showaku, Nagoya, Japan.
Walker Pump Co.
546 Eleventh St.
Brooklyn, N. Y.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

BLAST CLEANING EQUIPMENT (Hydraulic)

Automation Services
P. O. Box 5554
Detroit 38, Mich.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.

BLOWERS (Furnace)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
American Air Filter Co.
266 Central Ave.
Louisville 8, Ky.
Campbell-Hausfeld Co.
Harrison, Ohio.
Garden City Fan Co.
801 North Eighth St.
P. O. Box 223
Niles, Mich.
Ingersoll-Rand Co.
11 Broadway
New York, N. Y.
Johnston Mfg. Co.
Minneapolis 13, Minn.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
Spencer Turbine Co.
Hartford, Conn.
Wheelabrator Corp.
505 S. Byrkit St.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.
Mishawaka, Ind.

BLOWPLATES (Core and Mold)

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.

BOARDS (Presser)

Adams Co.
Dubuque, Iowa.

BOARDS and PLATES (Bottom)

Adams Co.
Dubuque, Iowa.
American Foundry Flask Co.
2745 Southwest Blvd.
Kansas City 8, Mo.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
AWS Foundry Supplies & Eqt.
4727 South Hoyne Ave.
Chicago 9, Ill.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.
Mag-Alco Foundry
1640 Telegraph Rd.
Pontiac, Mich.
Midwest Pressure Casting Co.
1350 West Cermak Rd.
Chicago 8, Ill.
Moltrup Steel Products Co.
Beaver Falls, Pa.
Nomad Equipment Corp.
3110 W. Fond du Lac Ave.
Milwaukee 10, Wis.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Sterling National Industries, Inc.
7036 W. Walker St.
Milwaukee 14, Wis.

BOND CLAY—See CLAY (Bonding)

BOOKS (Technical)

Penton Publishing Co.
1213 W. 3rd St.
Cleveland 13, Ohio.

BOWLS and SHANKS

Industrial Equipment Co.
Minster, Ohio.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

BOXES (Stacking, Tote, Storage & Shipping)

Kirk & Blum Co.
3108 Forrer St.
Cincinnati 9, Ohio.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Wirebound Box Mfg. Assoc.
222 West Adams St.
Chicago 6, Ill.

BRASS and BRONZE INGOTS

Federated Metals Div. of American Smelting & Refining Co.
120 Broadway
New York 5, N. Y.

BRIQUETS—See Type of Compound

BRIQUETTING MACHINES

Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Taccone Corp.
Box E-512
North East, Pa.

BRUSHES (Bristle)

Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.

BRUSHES (Electrical)

United States Graphite Co.
Saginaw, Mich.

BUCKETS (Elevating, Clam Shell, Drag Line, Grab, Loader, Dumping)

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
Chase Foundry & Mfg. Co.
2300 Parsons Ave.
Columbus 7, Ohio.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Great Western Mfg. Co.
Leavenworth, Kans.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Modern Equipment Co.
Port Washington, Wis.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Newaygo Engineering Co.
Newaygo, Mich.
Pekay Machine & Engineering Co.
2510 W. Lake St.
Chicago 12, Ill.
Penn Iron Works, Inc.
Reading, Pa.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Stephens-Adamson Mfg. Co.
Aurora, Ill.
Webster Mfg. Co.
Tiffin, Ohio.
Whirl-Air-Flow Corp.
650 25th Ave., S.E.
Minneapolis 14, Minn.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

BUILDING and ENGINEERING SERVICE

American Bridge Div.
United States Steel Corp.
525 Wm. Penn Place
Pittsburgh 19, Pa.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Swindell-Dressler Corp.
Box 188
Pittsburgh 30, Pa.
Taccone Corp.
Box E-512
North East, Pa.

BURNERS (Acetylene, Oil, Gas, Powdered Coal, Stoker)

American Combustion Equipment Co.
614 Twelfth St., N.W.
Canton 3, Ohio.
E. W. Bliss Co.
1375 Raff Rd., Southwest
Canton 10, Ohio.
Johnston Mfg. Co.
Minneapolis 13, Minn.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.

BUSHINGS — See FLASK BUSHINGS, PINS, and FITTINGS

BUTTS (Sand Rammer)

Arrow Butt Co.
4800 W. 139th St.
Cleveland 35, Ohio.
Thor Power Tool Co.
35 North State St.
Aurora, Ill.

CALCIUM ALLOYS

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals, Inc.
New York 14, N. Y.
303 West 10th St.

CAR MOVERS

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Frank G. Hough Co.
703 Sunnyside Ave.
Libertyville, Ill.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Webster Mfg. Co.
Tiffin, Ohio.

CARBON BOOSTER

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Great Lakes Carbon Corp.
579 Fifth Ave.
New York 36, N. Y.
National Carbon Co., Div.
Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.
Superior Graphite Co.
33 South Clark St.
Chicago 3, Ill.
United States Graphite Co.
Saginaw, Mich.

CARBON DIOXIDE—See GAS

CARS (Core, Mold, Heat Treating Oven)

Carl Mayer Corp.
20800 Center Ridge Rd.
Cleveland 16, Ohio.
Chase Foundry & Mfg. Co.
2300 Parsons Ave.
Columbus 7, Ohio.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.

CASTING GRIPS (Air Powered)

Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.

CASTING MACHINES (Centrifugal)

Centrifugal Casting Machine Co.
Tulsa, Okla.
Herman Pneumatic Machine Co.
Union Bank Bldg.
Pittsburgh 22, Pa.
Taccone Pneumatic
Fdry. Equipment Co.
P. O. Box 468
North East, Pa.

CASTING MACHINES (Die)

B & T Machinery Co.
Div. Greenlee Bros. & Co.
Rockford, Ill.
Kux Machine Co.
6725 North Ridge Ave.
Chicago 26, Ill.

CASTING MACHINES (Permanent Mold)

Centrifugal Casting Machine Co.
Tulsa, Okla.
Permanent Mold Die Co.
2275 East 9 Mile Rd.
Hazel Park, Mich.
Taccone Corp.
Box E-512
North East, Pa.

CASTING MACHINES (Pig)

Bailey, Wm., Co.
Pittsburgh 16, Pa.

CASTING SEALER—See IMPREGNATING SYSTEMS

CASTINGS

Acme Foundry Co.
2503—22nd St.
Detroit 16, Mich.
Link-Belt Company
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Webster Mfg. Co.
Tiffin, Ohio.

CEMENT (Metallic)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Ren Plastics, Inc.
5422 South Cedar St.
Lansing 9, Mich.
Smooth-On Mfg. Co.
570 Communipaw Ave.
Jersey City 4, N. J.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.

CEMENT (Refractory)

Babcock & Wilcox Co.
161 E. 42nd St.
New York 17, N. Y.
A. P. Green Fire Brick Co.
Mexico, Mo.
Harbison-Walker Refractories Co.
307 Fifth Ave.
Pittsburgh 22, Pa.
Ironton Fire Brick Co.
Ironton, Ohio.
Kaiser Refractories and Chemical Div.
300 Lakeside Drive
Oakland 12, Calif.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
North American Refractories Co.
East 6th National City Bank Bldg.
Cleveland 14, Ohio.
Norton Co.
Worcester 6, Mass.
Chas. Taylor Sons Co.
710 Burns St.
Cincinnati 4, Ohio.

CHAIN (Hoist, Conveyor, Drive, Sling, etc.)

American Chain Div.
American Chain & Cable Co. Inc.
York, Pa.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Columbus-McKinnon Chain Corp.
Tonawanda, N. Y.
Great Western Mfg. Co.
Leavenworth, Kans.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Stephens-Adamson Mfg. Co.
Aurora, Ill.
Sterling National Industries Inc.
7036 W. Walker St.
Milwaukee 14, Wis.
S. G. Taylor Chain Co.
Hammond, Ind.
Webster Mfg. Co.
Tiffin, Ohio.

CHAPLETS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Cleveland Chaplet & Mfg. Co.
26470 Lakeland Blvd.
Cleveland 23, Ohio.
Combined Supply & Equipment Co., Inc.
215 Chandler St.
Buffalo 7, N. Y.
Fanner Mfg. Co.
Brookside Park
Cleveland 9, Ohio.
Milwaukee Chaplet & Mfg. Co.
1023 S. 40th St.
Milwaukee 4, Wis.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.

CHARGING MACHINES (Cupola)

Bartlett & Snow, C. O., Co.
(Grindle Division)
6201 Harvard Ave.
Cleveland 5, Ohio.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Modern Equipment Co.
Port Washington, Wis.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Shepard-Niles Crane & Hoist Corp.
360 Schuyler Ave.
Montour Falls, N. Y.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CHEMICALS

General Chemical Division
Allied Chemical Corp.
40 Rector St.
New York 6, N. Y.
B. F. Goodrich Chemical Co.
3135 Euclid Ave.
Cleveland 15, Ohio.
Hercules Powder Co.
Wilmington 99, Del.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Olin Mathieson Chemical Corp.
400 Park Ave.
New York, N. Y.
Philadelphia Quartz Co.
1062 Public Ledger Bldg.
Philadelphia 6, Pa.
Reichhold Chemicals, Inc.
525 N. Broadway
White Plains, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.

CHILLS

Cleveland Chaplet & Mfg. Co.
26470 Lakeland Blvd.
Cleveland 23, Ohio.
Combined Supply & Equipment Co. Inc.
215 Chandler St.
Buffalo 7, N. Y.
Fanner Mfg. Co.
Brookside Park
Cleveland 9, Ohio.
Milwaukee Chaplet & Mfg. Co.
1023 S. Fourth St.
Milwaukee 4, Wis.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Standard Horse Nail Corp.
New Brighton, Pa.

CHILL COATINGS

Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.

CHIPPERS—See PORTABLE POWER TOOLS

CHROMIUM (Briquets)

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Ohio Ferro Alloys Corp.
Canton, Ohio.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 6, N. Y.

CLAMPS (Flask)

American Foundry Flask Co.
2745 Southwest Blvd.
Kansas City 8, Mo.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Herman Pneumatic Machine Co.
Union Bank Bldg.
Pittsburgh 22, Pa.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Sterling National Industries, Inc.
7036 W. Walker St.
Milwaukee 14, Wis.

CLAY (Bonding)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Baroid Chemicals Inc.
Sub. National Lead Co.
P. O. Box 1675
Houston 2, Tex.
Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Cedar Heights Clay Co.
Oak Hill, Ohio.
Eastern Clay Products Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
A. P. Green Fire Brick Co.
Mexico, Mo.
Harbison-Walker Refractories Co.
307 Fifth Ave.
Pittsburgh 22, Pa.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Ironton Fire Brick Co.
Ironton, Ohio.
Magnet Cove Barium Corp.
P. O. Box 6504
Houston 5, Texas.
North American Refractories Co.
East 6th National City Bank Bldg.
Cleveland 14, Ohio.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

CLAY (Refractory)—See REFRACTORIES

CLEANING COMPOUNDS

Combined Supply & Equipment Co., Inc.
215 Chandler St.
Buffalo 7, N. Y.
Philadelphia Quartz Co.
1062 Public Ledger Bldg.
Philadelphia 6, Pa.

CLOTH (Heat Resistant)

Raybestos Manhattan, Inc.
Asbestos-Textile Div.
Manheim, Pa.

COBALT ALLOYS

WalMet Alloys Co.
5320 Oakman Blvd.
Dearborn, Mich.

COKE (Oven)

Alabama By-Products Corp.
P. O. Box 354
Birmingham 1, Ala.
DeBardeleben Coal Corp.
2201 First Ave. N.
Birmingham 3, Ala.
Diamond Alkali Co.
300 Union Commerce Bldg.
Cleveland 14, Ohio.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Koppers Co., Inc.
Kearny, N. J.
Pickands Mather & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Pittsburgh Coke & Chemical Co.
Grant Bldg.
Pittsburgh 19, Pa.
Semet Solvay Div.
Allied Chemical Corp.
40 Rector St.
New York 6, N. Y.

COKE (Petroleum)

Great Lakes Carbon Corp.
18 E. 48th St.
New York 17, N. Y.

COMPRESSORS (Air)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Atlas Copco
545 Fifth Ave.
New York 17, N.Y.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Curtis Pneumatic Machinery Div.
Curtis Mfg. Co.
1905 Kienlen Ave.
St. Louis 20, Mo.
Davey Compressor Co.
Kent, Ohio
Gardner-Denver Co.
Gardner Drive
Quincy, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Spencer Turbine Co.
Hartford, Conn.

CONTROLLERS (Magnet)

Ohio Electric Mfg. Co.
5400 Dunham Rd.
Maple Heights, Ohio.

CONVERTERS (Bessemer)

Whiting Corporation
15607 Lathrop Ave.
Harvey, Ill.

CONVERTERS (Dry Ice)

Marison Co.
East State & River St.
South Elgin, Ill.

CONVEYOR DESIGN

Ajax Flexible Coupling Co. Inc.
Westfield, N. Y.
Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
C & S Products Co.
18656 Fitzpatrick Ave.
Detroit 28, Mich.

Cleveland Tramrail Div.
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Mathews Conveyer Co.
104 Tenth St.
Ellwood City, Pa.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Taccone Corp.
Box E-512
North East, Pa.
Webster Mfg. Co.
Tiffin, Ohio.

CONVEYORS (Chain)

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Logan Co.
580 Cabel
Louisville, Ky.
Mathews Conveyer Co.
104 Tenth St.
Ellwood City, Pa.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Newaygo Engineering Co.
Newaygo, Mich.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Richards-Wilcox Mfg. Co.
174 Third St.
Aurora, Ill.
Standard Conveyor Co.
North St. Paul 9, Minn.
Webster Mfg. Co.
Tiffin, Ohio.

CONVEYORS (Fabric, Rubber Belt)

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone & Mulliken Corp.
2424 N. Cicero
Chicago 39, Ill.
C & S Products Co.
18656 Fitzpatrick Ave.
Detroit 28, Mich.
F. E. (North America) Ltd.
47 Advance Rd.
Toronto 18, Canada.
B. F. Goodrich Co.
Industrial Div.
Akron, Ohio.
Great Western Mfg. Co.
Leavenworth, Kans.
Imperial Belting Co.
1750 S. Kilbourne
Chicago 23, Ill.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Logan Co.
580 Cabel
Louisville, Ky.
Mathews Conveyer Co.
104 Tenth St.
Ellwood City, Pa.
Modern Equipment Co.
Port Washington, Wis.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Newaygo Engineering Co.
Newaygo, Mich.
Nomad Equipment Corp.
3110 West Fond du Lac
Milwaukee 10, Wis.
Pekay Machine & Engineering Co.
2510 W. Lake St.
Chicago 12, Ill.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Standard Conveyor Co.
North St. Paul 9, Minn.
Stephens-Adamson Mfg. Co.
Aurora, Ill.
United States Rubber Co.
1230 Ave. of the Americas
New York 20, N. Y.
Webster Mfg. Co.
Tiffin, Ohio.

CONVEYORS (Gravity Roller)

F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Logan Co.
580 Cabel
Louisville, Ky.
Mathews Conveyer Co.
104 Tenth St.
Ellwood City, Pa.
Standard Conveyor Co.
North St. Paul 9, Minn.
Taccone Corp.
Box E-512
North East, Pa.

CONVEYOR (Live Roller)

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
F. E. (North America) Ltd.
47 Advance Rd.
Toronto 18, Canada.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Logan Co.
580 Cabel
Louisville, Ky.
Mathews Conveyer Co.
104 Tenth St.
Ellwood City, Pa.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Standard Conveyor Co.
North St. Paul 9, Minn.
Taccone Corp.
Box E-512
North East, Pa.

CONVEYORS (Mold)

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero
Chicago 39, Ill.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Logan Co.
580 Cabel
Louisville, Ky.
Mathews Conveyer Co.
104 Tenth St.
Ellwood City, Pa.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Newaygo Engineering Co.
Newaygo, Mich.
Nomad Equipment Corp.
3110 W. Fond du Lac Ave.
Milwaukee 10, Wis.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Taccone Corp.
Box E-512
North East, Pa.
Webster Mfg. Co.
Tiffin, Ohio.

CONVEYORS (Overhead Monorail)

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Chicago Tramrail Co.
1330 South Kostner Ave.
Chicago 23, Ill.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Mathews Conveyer Co.
104 Tenth St.
Ellwood City, Pa.
Modern Equipment Co.
Port Washington, Wis.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Penn Iron Works Inc.
Reading, Pa.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Richards-Wilcox Mfg. Co.
174 Third St.
Aurora, Ill.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CONVEYORS (Pneumatic)

National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Spencer Turbine Co.
Hartford, Conn.
Whirl Air Flow Corp.
650—25th Ave. S.E.
Minneapolis 14, Minn.

CONVEYORS (Portable)

C & S Products Co.
18656 Fitzpatrick Ave.
Detroit 28, Mich.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.

CONVEYORS (Vibrating, Oscillating)

Ajax Flexible Coupling Co., Inc.
Westfield, N. Y.
Carrier Conveyor Div.
Chain Belt Co.
211 N. Jackson St.
Louisville 2, Ky.
Cleveland Vibrator Co.
2828 Clinton Ave. W.
Cleveland 13, Ohio.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Simplicity Engineering Co.
Durand, Mich.
Stephens-Adamson Mfg. Co.
Aurora, Ill.

COOLING EQUIPMENT—
See VENTILATING, EXHAUST & COOLING EQUIPMENT

COPPER and COPPER SHOT

Federated Metals Div., American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

CORE BLOWER BUSHINGS

Eastern Clay Products Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
Martin Engineering Co.
Neponset, Ill.

CORE BLOWING and SHOOTING MACHINES

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero
Chicago 39, Ill.
C & S Products Co.
18656 Fitzpatrick Ave.
Detroit 28, Mich.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero
Chicago 39, Ill.
Demmler Mfg. Co.
Kewanee, Ill.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Hansberg Shooters, Inc.
3213 Central
Evanston, Ill.
Harrison Machine Co.
2725 Station Rd.
Wesleyville, Pa.
International Molding Machine Co.
LaGrange Park, Ill.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
Redford Iron & Equipment Co.
20733 Glendale Ave.
Detroit 23, Mich.
Sutter Products Co.
Hadley & Grant Sts.
Holly, Mich.
Taccone Corp.
Box E-512
North East, Pa.

COREBOXES

Accurate Match Plate Co.
1847 W. Carroll Ave.
Chicago, Ill.
Central Pattern Co.
Quincy, Ill.

CORE DRAWING MACHINES—See STRIPPING, DRAWING and ROLLOVER MACHINES

CORE KNOCK-OUT MACHINES

Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

COREMAKING MACHINES

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero
Chicago 39, Ill.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
A. C. Chris Co.
1737 W. 91st St.
Chicago 20, Ill.
Demmler Mfg. Co.
Kewanee, Ill.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada
Harrison Machine Co.
2725 Station Rd.
Wesleyville, Pa.
Herman Pneumatic Machine Co.
Union Bank Bldg.
Pittsburgh 22, Pa.
International Molding Machine Co.
LaGrange Park, Ill.
Johnston & Jennings Div.
Pettibone Mulliken Corp.
2424 N. Cicero
Chicago 39, Ill.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
Redford Iron & Equipment Co.
20733 Glendale Ave.
Detroit 23, Mich.
SPO, Inc.
7500 Grand Division Ave.
Cleveland 25, Ohio.
Sutter Products Co.
Hadley & Grant Sts.
Holly, Mich.
Tabor Mfg. Co., Div.
Turbo Machine Co.
Lansdale, Pa.
Taccone Corp.
Box E-512
North East, Pa.
Wadsworth Equipment Co.
2477 Mogadore Rd.
Akron, Ohio.

CORES (Strainer, Riser, Breakoff)

Akron Porcelain Co.
Akron, Ohio.
Ferro Corp.
Louthan Div.
East Liverpool, Ohio.
Rudow Mfg. Co.
2602 Venice Rd.
Sandusky, Ohio.
Universal Clay Products
Sandusky, Ohio.

CORE TESTING EQUIPMENT

Detroit Testing Machine Co.
9390 Grinnell Ave.
Detroit 13, Mich.
Harry W. Dietert Co.
9330 A Roselawn Ave.
Detroit 4, Mich.
Claud S. Gordon Co.
3000 S. Wallace
Chicago 16, Ill.

COUNTERS (Castings, Cores, Molds)

Hartley Controls Corp.
P. O. Box 290
Neenah, Wis.

COUPLINGS (Air, Hydraulic)

Airetool Mfg. Co.
Springfield, Ohio.
Bellows Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Tex.
B. F. Goodrich Co.
Industrial Div.
Akron, Ohio.
Hunt Valve Co.
1913 East State St.
Salem, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

COUPLINGS (Flexible, Shaft)

Ajax Flexible Coupling Co., Inc.
Westfield, N. Y.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.

COVERS (Annealing)

Webster Mfg. Co.
Tiffin, Ohio.

CRANES (Bucket)

Cleveland Tramrail Div:
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CRANES (Gantry)

Cleveland Tramrail Div.:
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Euclid Crane & Hoist Co.
1365 Chardon Rd.
Cleveland 17, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.
Modern Equipment Co.
Port Washington, Wis.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CRANES (Jib)

American Chain & Cable Co., Inc.
Wright Hoist Div.
York, Pa.
Chicago Tramrail Co.
1330 South Kostner Ave.
Chicago 23, Ill.
Chisholm-Moore Hoist Div.
Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Euclid Crane & Hoist Co.
1365 Chardon Rd.
Cleveland 17, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.
Modern Equipment Co.
Port Washington, Wis.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CRANES (Monorail—Electric and Hand)

American Chain & Cable Co., Inc.
Wright Hoist Div.
York, Pa.
Chicago Tramrail Co.
1330 South Kostner Ave.
Chicago 23, Ill.
Chisholm-Moore Hoist Div.
Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Euclid Crane & Hoist Co.
1365 Chardon Rd.
Cleveland 17, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.
Modern Equipment Co.
Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp.
360 Schuyler Ave.
Montour Falls, N. Y.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CRANES (Self-Propelled)

American Chain & Cable Co., Inc.
Wright Hoist Div.
York, Pa.
Cleveland Tramrail Div.
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.
Modern Equipment Co.
Port Washington, Wis.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CRANES (Stacker)

Chicago Tramrail Co.
1330 South Kostner Ave.
Chicago 23, Ill.
Cleveland Tramrail Div.
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.

CRUCIBLES

Ajax Magnethermic Corp.
3990 Simon Rd.
Youngstown 1, Ohio.
American Combustion Equipment Co.
614 Twelfth St., N.W.
Canton 3, Ohio.
American Refractories & Crucible Corp.
North Haven, Conn.
Crucible Manufacturers Association
11 W. 42nd St.
New York 36, N. Y.
Dixon, Joseph, Crucible Co.
Jersey City 3, N. J.
Electro Refractories & Abrasives Corp.
Vars Bldg.
Buffalo 2, N. Y.
Great Lakes Carbon Co.
18 E. 48th St.
New York 17, N. Y.
Inductotherm Corp.
412 Illinois Ave.
Delanco, N. J.
Lava Crucible Co.
Pittsburgh, Pa.
National Carbon Co., Div.
Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.
Ross-Tacony Crucible Co.
Tacony, Philadelphia, Pa.
Speer Carbon Co.
St. Marys, Pa.
Vesuvius Crucible Co.
Swissvale, Pa.

CRUSHERS (Core)

Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Newaygo Engineering Co.
Newaygo, Mich.
Simplicity Engineering Co.
Durand, Mich.

CUPOLA PICKS

Industrial Equipment Co.
Minster, Ohio.

CUPOLAS

Bartlett & Snow, C. O., Co.
(Grindle Division)
6201 Harvard Ave.
Cleveland 5, Ohio.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
Modern Equipment Co.
Port Washington, Wis.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

CUTOFF MACHINES (Abrasive)

DoAll Co.
Des Plaines, Ill.
A. P. Green Fire Brick Co.
Mexico, Mo.
Tabor Mfg. Co., Div. Turbo Machine Co.
Lansdale, Pa.
U. S. Electrical Tool Co.
3640 Llewellyn St.
Cincinnati 23, Ohio.

CUTOFF WHEELS

American Crownflex Abrasive Wheel Mfg. Co.
Delanco, N. J.
P. O. Box 123
Riverside, N. J.
Bay State Abrasive Products Co.
Westboro, Mass.
Carborundum Co.
Niagara Falls, N. Y.
Cincinnati Milling Products Div.
4701 Marburg Ave.
Cincinnati 9, Ohio.
A. P. Green Fire Brick Co.
Mexico, Mo.
Macklin Company
Jackson, Mich.
Norton Company
Worcester 6, Mass.
Raybestos-Manhattan, Inc.
Manhattan Rubber Division
Passaic, N. J.
Simonds Abrasive Co.
Tacony & Fraley Sts.
Philadelphia 37, Pa.
Union Carbide Metals Co., Div. of Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.

CYLINDERS (Air, Hydraulic)

Bellows Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.
Hannifin Co.
Div. Parker Hannifin Corp.
637-D South Wolf Road
Des Plaines, Ill.
The Oilgear Co.
1560 West Pierce St.
Milwaukee 4, Wis.
SP Mfg. Corp.
20301 Aurora Rd.
Solon, Ohio.
Taccone Corp.
Box E-512
North East, Pa.
Tomkins-Johnson Co.
2425 West Michigan Ave.
Jackson, Mich.

DEGASIFIERS and DEOXIDIZERS

Carborundum Co.
Niagara Falls, N. Y.
Cleveland Flux Co.
1026 Main St.
Cleveland 13, Ohio.
Federated Metals Div., American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa
Lithium Corp. of America Inc.
500 Fifth Ave.
New York 36, N. Y.
Pittsburgh Metals Purifying Co.
P. O. Box 568
Mars, Pa.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 West 10th St.
New York 14, N. Y.

DEGASSING EQUIPMENT (Vacuum)

Centrifugal Casting Machine Co.
Tulsa, Okla.
Meltronics, Inc.
1010 North Main St.
Elkhart, Ind.

DESIGN TESTING

Magnaflux Corp.
7300 W. Lawrence Ave.
Chicago 31, Ill.

DESULPHURIZERS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Cleveland Flux Co.
1026 Main St.
Cleveland 13, Ohio.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Hercules Powder Co.
Wilmington 99, Del.
Modern Equipment Co.
Port Washington, Wis.
Olin Mathieson Chemical Corp.
400 Park Ave.
New York, N. Y.
Pittsburgh Metals Purifying Co.
P. O. Box 568
Mars, Pa.
Whitehead Metals Inc.
303 West 10th St.
New York 14, N. Y.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

DIE BLOCKS (Die Casting)

Tiffin Foundry Co.
West Adams St.
Tiffin, Ohio.

DIES (Diecasting)

Central Pattern Co.
Quincy, Ill.
Detroit Mold Engineering Co.
6686 E. McNichols
Detroit 12, Mich.
Permanent Mold Die Co.
2275 East 9 Mile Rd.
Hazel Park, Mich.

DOORS (Open Hearth)

Bailey Wm. M., Co.
Pittsburgh 16, Pa.

DOWEL PINS

Standard Horse Nail Corp.
New Brighton, Pa.

DRESSERS (Grinding Wheel)

Chicago Wheel & Mfg. Co.
1101 W. Monroe
Chicago 7, Ill.

Desmond-Stephan Mfg. Co.
Urbana, Ohio.
Machine Products Corp.
125 Hollier
Dayton 3, Ohio.
Norton Company
Worcester 6, Mass.

DRILLS (Electric)

Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Thor Power Tool Co.
35 North State St.
Aurora, Ill.
U. S. Electrical Tool Co.
3640 Llewellyn St.
Cincinnati 23, Ohio.

DRILLS (Pneumatic)

Airetool Mfg. Co.
Springfield, Ohio.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Gardner-Denver Co.
Quincy, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Master Power Corp.
Sub. Black & Decker Corp.
6225 Cochran Rd.
Solon 39, Ohio.
Thor Power Tool Co.
35 North State St.
Aurora, Ill.

DRIVES (Gear, Variable Speed)

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
The Oilgear Co.
1560 West Pierce St.
Milwaukee 4, Wis.

DRUMS (Magnetic)—See SEPARATORS (Magnetic)

DRYERS (Core)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Midwest Pressure Casting Co.
1350 West Cermak Rd.
Chicago 8, Ill.

DRYERS (Mold)

Foundry Equipment Co.
1837 Columbus Rd.
Cleveland 13, Ohio.
Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.

DRYERS (Sand)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Davenport Machine & Foundry Co.
Davenport, Iowa.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Nichols Engineering & Research Corp.
70 Pine St.
New York 5, N. Y.

DUST, FUME and FLY ASH CONTROL EQUIPMENT

American Air Filter Co., Inc.
266 Central Ave.
Louisville 8, Ky.
Bartlett & Snow, C. O., Co. (Grindle Division)
6201 Harvard Ave.
Cleveland 5, Ohio.
Benedict Chemicals Inc.
213 North Front St.
New Haven, Conn.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Fly Ash Arrestor Corp.
P. O. Box 1883
Birmingham 3, Ala.
Hammond Machinery Builders
1600 Douglas Ave.
Kalamazoo 54, Mich.
Hawley Mfg. Co.
411 North Wabash
Wabash, Ind.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.
Modern Equipment Co.
Port Washington, Wis.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Claude B. Schneible Co.
P. O. Box 296, Roosevelt Park
Detroit 32, Mich.
Standard Electrical Tool Co.
2488 River Road
Cincinnati 4, Ohio.
Tabor Mfg. Co.
Div. Turbo Machine Co.
Lansdale, Pa.
U. S. Electrical Tool Co.
3640 Llewellyn St.
Cincinnati 23, Ohio.
Western Precipitation Div.
Joy Mfg. Co.
1000 West 9th St.
Los Angeles 15, Calif.
Wheelabrator Corp.
505 S. Byrkit
Mishawaka, Ind.
Wolverine Equipment Co.
745 Concord Ave.
Cambridge 38, Mass.

EDUCATION (Training Course)

American Society for Metals
Metals Park
Novelty, Ohio

ELECTRODE HOLDERS AND BUS TUBES (Rebuilding Service)

Wilson Welding Company, Inc.
221 High St., Altizer Addition
Huntington, W. Va.

ELECTRODES, FURNACE (Graphite and Amorphous)

Great Lakes Carbon Corp.
18 E. 48th St.
New York 17, N. Y.
International Graphite & Electrode Div.
Speer Carbon Co.
St. Marys, Pa.
National Carbon Co., Div.
Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.

ELECTRODES and RODS (Welding)

American Steel & Wire Div.
U. S. Steel Corp.
Rockefeller Bldg.
Cleveland 13, Ohio.
Arcair Co.
465 South Mt. Pleasant Ave.
Lancaster, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
International Nickel Co., Inc.
67 Wall St.
New York 5, N. Y.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.
National Carbon Co., Div.
Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.
Rexarc, Inc.
West Alexandria, Ohio.
Speer Carbon Co.
St. Marys, Pa.
United States Graphite Co.
Saginaw, Mich.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

ELEVATORS (Bucket)—See BUCKETS (Elevating, Clam Shell, Drag Line, Grab, Loader, Dumping)

ENGINEERING SERVICE (Foundry)

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
Edwin S. Carman
1643 Lee Road
Cleveland 18, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
International Automation Corp.
Ann Arbor, Mich.
Lester B. Knight & Associates, Inc.
549 W. Randolph St.
Chicago 6, Ill.
D. C. Latella & Assoc., Inc.
624 Widener Bldg.
Philadelphia 7, Pa.
States Engineering Corp.
243 East Murray St.
Ft. Wayne 2, Ind.
Taccone Corp.
Box E-512
North East, Pa.

EXHAUST EQUIPMENT—See VENTILATING, EXHAUST & COOLING EQUIPMENT

EXOTHERMIC COMPOUNDS

Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Ohio Ferro Alloys Corp.
Canton, Ohio.
Pittsburgh Metals Purifying Co.
P. O. Box 568
Mars, Pa.
United States Graphite Co.
Saginaw, Mich.
Whitehead Metals Inc.
303 West 10th St.
New York 14, N. Y.

FABRICATORS (Metal)

American Combustion Equipment Co.
614 Twelfth St., N.W.
Canton 3, Ohio.
Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Modern Equipment Co.
Port Washington, Wis.
Newaygo Engineering Co.
Newago, Mich.
Pekay Machine & Engineering Co.
2510 W. Lake St.
Chicago 12, Ill.
Penn Iron Works, Inc.
Reading, Pa.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Spincraft, Inc.
4122 W. State St.
Milwaukee 8, Wis.
Taconne Corp.
Box E-512
North East, Pa.

FACINGS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Delta Oil Products Co.
6263 Cedarbury Rd.
Milwaukee 9, Wis.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
National Carbon Co.
Div. Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.
Penn-Rilton Co.
324 W. 23rd St.
New York 11, N. Y.
G. E. Smith, Inc.
246 Washington Rd.
Pittsburgh 16, Pa.
Stevens Inc., Frederic B.
18th & Vernor Highway
Detroit 16, Mich.
Superior Graphite Co.
33 S. Clark St.
Chicago 3, Ill.
United States Graphite Co.
Saginaw, Mich.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

FANS—See VENTILATING, EXHAUST & COOLING EQUIPMENT

FEEDERS (Belt)

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Webster Mfg. Co.
Tiffin, Ohio.

FEEDERS (Plate)

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Great Western Mfg. Co.
Leavenworth, Kans.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
National Air Vibrator Co.
435 Literary Ave.
Cleveland 13, Ohio.
Newago Engineering Co.
Newago, Mich.

FEEDERS (Screw)

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.

FEEDERS (Vibrating)

Ajax Flexible Coupling Co. Inc.
Westfield, N. Y.
Carrier Conveyor Div.
Chain Belt Co.
211 N. Jackson St.
Louisville 2, Ky.
Cleveland Vibrator Co.
2828 Clinton Ave. W.
Cleveland 13, Ohio.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Simplicity Engineering Co.
Durand, Mich.

FERROBORON

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.

Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FERROCHROME

Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Ohio Ferro Alloys Corp.
Canton 9, Ohio.
Pickands Mather & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FERROCOLUMBIUM

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FERROMANGANESE

Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Ohio Ferro Alloys Corp.
Canton 9, Ohio.
Pittsburgh Coke & Chemical Co.
Grant Bldg.
Pittsburgh 19, Pa.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FERROMOLYBDENUM

Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.

FERROPHOSPHORUS

Eastern Clay Products Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.

FERROSILICON

Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Miller & Company
332 S. Michigan Ave.
Chicago 4, Ill.
Ohio Ferro Alloys Corp.
Canton 9, Ohio.
Pickands Mather & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FERROTITANIUM

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.

FERROTUNGSTEN

Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FERROVANADIUM

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FILLERS (Flask)

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero
Chicago 39, Ill.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Newaygo Engineering Co.
Newago, Mich.
Parker-Hannifin Corp.
17325 Euclid Ave.
Cleveland 12, Ohio.
Taccone Corp.
Box E-512
North East, Pa.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

FILTERS and SEPARATORS (Compressed air contaminants)

American Air Filter Co.
226 Central Ave.
Louisville 8, Ky.
Bellows Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.
Hannifin Co.
Div. Parker-Hannifin Corp.
637-D South Wolf Road
Des Plaines, Ill.
James A. Murphy & Co.
Hamilton, Ohio.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

FINISHING BARRELS (Rotating & Vibrating)

Almco Products Div.
King Seeley Corp.
Albert Lea, Minn.
Minnesota Mining & Mfg. Co.
900 Fauquier St.
St. Paul 6, Minn.
Pangborn Corp.
Hagerstown, Md.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

FIRE BRICK, CLAY, SAND, STONE—See REFRACTORIES

FLASK BUSHINGS, FITTINGS and PINS

Adams Co.
Dubuque, Iowa.
American Foundry Flask Co.
2745 Southwest Blvd.
Kansas City 8, Mo.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.
Newaygo Engineering Co.
Newaygo, Mich.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Smillie & Co., C. M.
1124 Woodward Hgts. Blvd.
Ferndale 20, Mich.
Sterling National Industries, Inc.
7036 W. Walker St.
Milwaukee 14, Wis.

FLASKS (Aluminum, Magnesium)

Adams Co.
Dubuque, Iowa.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Fremont Flask Co.
Fremont, Ohio.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.
Newaygo Engineering Co.
Newaygo, Mich.

FLASKS (Slip)

Adams Co.
Dubuque, Iowa.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Fremont Flask Co.
Fremont, Ohio.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.
Newaygo Engineering Co.
Newaygo, Mich.

FLASKS (Snap)

Adams Co.
Dubuque, Iowa.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Fremont Flask Co.
Fremont, Ohio.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.
Newaygo Engineering Co.
Newaygo, Mich.
Frederic B. Stevens, Inc.
18th & Vernor Highway
Detroit 16, Mich.

FLASKS (Steel)

American Foundry Flask Co.
2745 Southwest Blvd.
Kansas City 8, Mo.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Sterling National Industries, Inc.
7036 W. Walker St.
Milwaukee 14, Wis.

FLASKS (Wood)

Adams Co.
Dubuque, Iowa.
AWS Foundry Supplies & Eqt.
4727 South Hoyne Ave.
Chicago 9, Ill.

FLOORING (Non-Slip)

Harbison-Walker Refractories Co.
307 Fifth Ave.
Pittsburgh 22, Pa.
Norton Co.
Worcester 6, Mass.

FLOUR (Silica)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Ottawa Silica Co.
Ottawa, Ill.
Pennsylvania Pulverizing Co.
140 Stanwix St.
Pittsburgh 22, Pa.
Standard Silica Co.
Ottawa, Ill.
Wedron Silica Co.
135 S. LaSalle St.
Chicago 3, Ill.

FLOUR (Wood Cornecb)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Eastern Clay Products Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.

FLUXES

Cleveland Flux Co.
1026 Main St.
Cleveland 13, Ohio.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
General Chemical Division
Allied Chemical Corp.
40 Rector St.
New York 6, N. Y.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
International Foundry Supply Co.
Water & Spruce Sts.
Reading, Pa.
Olin Mathieson Chemical Corp.
400 Park Ave.
New York, N. Y.
Pittsburgh Metals Purifying Co.
P. O. Box 568
Mars, Pa.
Superflux Mfg. Co.
16125 Cleophus Ave.
Allen Park 10, Mich.

FLY ASH COLLECTORS—See DUST, FUME & FLY ASH CONTROL EQUIPMENT

FOUNDRY ENGINEERS—See ENGINEERING SERVICE

FUME CONTROL—See DUST, FUME & FLY ASH CONTROL EQUIPMENT

FURNACES (Air)

American Combustion Equipment Co.
614 Twelfth St., N.W.
Canton 3, Ohio.
Loftus Engineering Corp.
No. 1 Gateway Center
Pittsburgh 22, Pa.
Swindell-Dressler Corp.
Box 188
Pittsburgh 30, Pa.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

FURNACES (Electric Melting)

Ajax Magnethermic Corp.
3900 Simon Rd.
Youngstown, Ohio.
Ajax Engineering Div.
Ajax Magnethermic Corp.
Trenton, N. J.
Brown Boveri Co.
19 Rector St.
New York 6, N. Y.
American Bridge, Div. United States Steel Corp.
525 Wm. Penn Pl.
Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co.
Bay City, Mich.
Hevi-Duty Electric Co.
304 W. Hart St.
Watertown, Wis.
Inductotherm Corp.
412 Illinois Ave.
Delanco, N. J.
Lectromelt Furnace Co. Div.
McGraw Edison Co.
P. O. Box 1125
Pittsburgh, Pa.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard St.
Chicago 12, Ill.
Loftus Engineering Corp.
No. 1 Gateway Center
Pittsburgh 22, Pa.
Ohio Crankshaft Co.
Tocco Division
4620 E. 71st St.
Cleveland 5, Ohio.

Swindell-Dressler Corp.
Box 188
Pittsburgh 30, Pa.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

FURNACES (Gas or Oil Fired Melting)

American Combustion Equipment Co.
614 Twelfth St., N.W.
Canton, Ohio.
Campbell-Hausfeld Co.
Harrison, Ohio.
Carl Mayer Corp.
20800 Center Ridge Rd.
Cleveland 16, Ohio.
Denver Fire Clay Co.
2301 Blake St.
Denver 2, Colo.
Despatch Oven Co.
619 Eighth St., S.E.
Minneapolis 14, Minn.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.
Hevi-Duty Electric Co.
304 W. Hart St.
Watertown, Wis.
International Foundry Supply Co.
Water & Spruce Sts.
Reading, Pa.
Johnston Mfg. Co.
Minneapolis 13, Minn.
Lanly Company
2800 Euclid Ave.
Cleveland 15, Ohio.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
Loftus Engineering Corp.
No. 1 Gateway Center
Pittsburgh 22, Pa.
Reda Pump Co.
Bartlesville, Okla.
Swindell-Dressler Corp.
Box 188
Pittsburgh 30, Pa.
U. S. Smelting Furnace Co.
Belleville, Ill.
Warwick Industrial Furnace & Engineering Corp.
452 West Chicago Ave.
Chicago 10, Ill.

FURNACES (Heat Treating and Annealing)

Ajax Magnethermic Corp.
3990 Simon Rd.
Youngstown 1, Ohio.
Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
American Combustion Equipment Co.
614 Twelfth St., N.W.
Canton, Ohio.
Carl Mayer Corp.
20800 Center Ridge Rd.
Cleveland 16, Ohio.
Despatch Oven Co.
619 Eighth St., S.E.
Minneapolis 14, Minn.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.
General Electric Co.
Schenectady, N. Y.
Hevi-Duty Electric Co.
304 W. Hart St.
Watertown, Wis.
Inductotherm Corp.
412 Illinois Ave.
Delanco, N. J.
Johnston Mfg. Co.
Minneapolis 13, Minn.
Lanly Company
2800 Euclid Ave.
Cleveland 15, Ohio.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
Loftus Engineering
No. 1 Gateway Center
Pittsburgh 22, Pa.
Michigan Oven Co.
419 Brainard St.
Detroit 1, Mich.
Ohio Crankshaft Co.
Tocco Division
4620 E. 71st St.
Cleveland 5, Ohio.
Swindell-Dressler Corp.
Box 188
Pittsburgh 30, Pa.
Whiting Corporation
15607 Lathrop Ave.
Harvey, Ill.

GAGGERS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Wadsworth Equipment Co.
2477 Mogadore Rd.
Akron, Ohio.
Warwick Industrial Furnace & Engineering Corp.
452 West Chicago Ave.
Chicago 10, Ill.

GAS (Oxygen, Acetylene, Carbon Dioxide, Industrial)

Cardox Corp.
Div. of Chemetron Corp.
804 North Michigan Ave.
Chicago 11, Ill.
Fosseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.
Pure Carbonic Company
Div. Air Reduction Co.
150 E. 42nd St.
New York 17, N. Y.

GASSING SYSTEMS and EQUIPMENT

Archer-Daniels-Midland Co.
Federal Foundry Supply Division
2191 W. 110th St.
Cleveland 2, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.
Pure Carbonic Company
Div. Air Reduction Co.
150 E. 42nd St.
New York 17, N. Y.

GENERATORS (Acetylene)

Rexarc, Inc.
West Alexandria, Ohio.

GENERATORS (Power)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Ready Power Co.
3826 Grand River Ave.
Detroit 8, Mich.

GLOVES—See SAFETY EQUIPMENT

GRAPHITE and GRAPHITE BRIQUETS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Great Lakes Carbon Corp.
18 E. 48th St.
New York 17, N. Y.
National Carbon Co. Div.
Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.
Stevens, Frederic B., Inc.
18th & Vernor Highway
Detroit 16, Mich.
Superior Graphite Co.
33 South Clark St.
Chicago 3, Ill.
United States Graphite Co.
Saginaw, Mich.

GRINDERS (Bench, Disc, Floor, Surface)

American Crownflex Abrasive Wheel Mfg. Corp.
Delanco, N. J.
P. O. Box 123
Riverside, N. J.
Chicago Wheel & Mfg. Co.
1101 W. Monroe
Chicago 7, Ill.
DoAll Co.
Des Plaines, Ill.
Grinding & Polishing Machinery Corp.
2530 Winthrop Ave.
Indianapolis 5, Ind.
Hammond Machinery Builders
1600 Douglas Ave.
Kalamazoo 54, Mich.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Oliver Machinery Co.
Grand Rapids 1, Mich.
Standard Electrical Tool Co.
2488 River Road
Cincinnati 4, Ohio.
Thor Power Tool Co.
Aurora, Ill.
U. S. Electrical Tool Co.
3640 Llewellyn St.
Cincinnati 23, Ohio.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Chicago Wheel & Mfg. Co.
1101 W. Monroe
Chicago 7, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Remington Arms Co.
Bridgeport 2, Conn.
Standard Electrical Tool Co.
2488 River Road
Cincinnati 4, Ohio.
Thor Power Tool Co.
Aurora, Ill.
U. S. Electrical Tool Co.
3640 Llewellyn St.
Cincinnati 23, Ohio.

GRINDERS (Pneumatic Portable)

Airetool Mfg. Co.
Springfield, Ohio.
Aro Equipment Corp.
Bryan, Ohio.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Texas.
Gardiner-Denver Co.
Gardner Drive
Quincy, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Master Power Corp.
Sub. Black & Decker Corp.
6225 Cochran Rd.
Solon 39, Ohio.
Thor Power Tool Co.
Aurora, Ill.
T. C. Wilson, Inc.
21-11 44th Ave.
Long Island City 1, N. Y.

GRINDERS (Swing Frame)

Grinding & Polishing Machinery Corp.
2530 Winthrop Ave.
Indianapolis 5, Ind.
U. S. Electrical Tool Co.
3640 Llewellyn St.
Cincinnati 23, Ohio.

GRINDING WHEELS

American Crownflex Abrasive Wheel Mfg. Corp.
Delanco, N. J.
P. O. Box 123
Riverside, N. J.
Atlantic Abrasive Products, Inc.
South Braintree 85, Mass.
Bay State Abrasive Products Co.
Westboro, Mass.
Carborundum Co.
Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co.
1101 W. Monroe
Chicago 7, Ill.
Cincinnati Milling Products Div.
4701 Marburg Ave.
Cincinnati 9, Ohio.
Fuller Merriam Co.
70 Water St.
West Haven 16, Conn.
Macklin Co.
Jackson, Mich.
Norton Company
Worcester 6, Mass.
Peninsular Grinding Wheel Co.
729 Meldrun Ave.
Detroit 7, Mich.
Raybestos-Manhattan, Inc.
Manhattan Rubber Division
Passaic, N. J.
Simonds Abrasive Co.
Tacony & Fraley Sts.
Philadelphia 37, Pa.
Sterling Grinding Wheel Co.
P. O. Box 801
Tiffin, Ohio.
United States Rubber Co.
1230 Ave. of the Americas
New York 20, N. Y.

GRIT—See SHOT and GRIT

HARDNESS TESTING EQUIPMENT

Detroit Testing Machine Co.
9390 Grinnell Ave.
Detroit 13, Mich.
Dietert, Harry W., Co.
9330A Roselawn Ave.
Detroit 4, Mich.
King Tester Corp.
440 North 13th St.
Philadelphia 23, Pa.
Steel City Testing Machines Inc.
8807 Lyndon
Detroit 38, Mich.

HEATERS (High Frequency Electric)

Ajax Magnethermic Corp.
3990 Simon Rd.
Youngstown 1, Ohio.
Inductotherm Corp.
412 Illinois Ave.
Delanco, N. J.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 11, Ill.
Ohio Crankshaft Co.
Tocco Div.
4620 E. 71st St.
Cleveland 5, Ohio.

HEATERS (Oven, Space, Unit, Water)

American Air Filter Co. Inc.
266 Central Ave.
Louisville 8, Ky.
Carl Mayer Corp.
20800 Center Ridge Rd.
Cleveland 16, Ohio.
Despatch Oven Co.
619 Eighth St., S.E.
Minneapolis 14, Minn.
Drying Systems, Inc.
1814 Foster Ave.
Chicago 40, Ill.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.
Lanly Co.
2800 Euclid Ave.
Cleveland 15, Ohio.
Modern Equipment Co.
Port Washington, Wis.
Space-Ray Corp.
306 West Tremont Ave.
Charlotte 3, N. C.

HELMETS (Blasting)

American Optical Co.
Southbridge, Mass.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Wheelabrator Corp.
505 S. Byrkit
Mishawaka, Ind.

HELMETS (Welding)

American Optical Co.
Southbridge, Mass.

HOISTS (Air)

Aro Equipment
Bryan, Ohio.
Atlas Capco
545 Fifth Ave.
New York 17, N. Y.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Curtis Pneumatic Machinery Div.
Curtis Mfg. Co.
1905 Kienlen Ave.
St. Louis 20, Mo.
Duff-Norton Co.
Four Gateway Center
Pittsburgh 22, Pa.
Euclid Crane & Hoist Co.
1365 Chardon Rd.
Cleveland 17, Ohio.
Gardner-Denver Co.
Quincy, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.
Master Power Corp.
Sub. Black & Decker Corp.
6225 Cochran Rd.
Solon 39, Ohio.
Thor Power Tool Co.
Aurora, Ill.
Yale & Towne Mfg. Co.
Roosevelt Blvd. & Haldeman Ave.
Philadelphia 15, Pa.

HOISTS (Chain, Hand)

American Chain & Cable Co., Inc.
Wright Hoist Div.
York, Pa.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Chicago Tramrail Co.
1330 South Kostner Ave.
Chicago 23, Ill.
Chisholm-Moore Hoist Div.
Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Euclid Crane & Hoist Co.
1365 Chardon Rd.
Cleveland 17, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.
Modern Equipment Co.
Port Washington, Wis.
Yale & Towne Mfg. Co.
Roosevelt Blvd. & Haldeman Ave.
Philadelphia 15, Pa.

HOISTS (Electric)

American Chain & Cable Co., Inc.
Wright Hoist Div.
York, Pa.
Chicago Tramrail Co.
1330 South Kostner Ave.
Chicago 23, Ill.
Chisholm-Moore Hoist Div.
Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Duff-Norton Co.
Four Gateway Center
Pittsburgh 22, Pa.
Euclid Crane & Hoist Co.
1365 Chardon Rd.
Cleveland 17, Ohio.
Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.
Modern Equipment Co.
Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp.
360 Schuyler Ave.
Montour Falls, N. Y.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.
Yale & Towne Mfg. Co.
Roosevelt Blvd. & Haldeman Ave.
Philadelphia 15, Pa.

HOISTS (Skip)

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
F. E. (North America) Ltd.
47 Advance Rd.
Toronto 18, Canada.
Gardner-Denver Co.
Quincy, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Modern Equipment Co.
Port Washington, Wis.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Newaygo Engineering Co.
Newaygo, Mich.
Webster Mfg. Co.
Tiffin, Ohio.
Whiting Corporation
15607 Lathrop Ave.
Harvey, Ill.

HOODS (Shakeout, Pouring and Cooling)—See DUST, COLLECTING, VENTILATING, EXHAUST, COOLING SYSTEMS

HOPPERS (Bulk Storage) —See BINS and GATES

HOPPERS (Dump)

Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.

HOSE (Air, Blasting, Water, Gas)

Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Gardner-Denver Co.
Quincy, Ill.
B. F. Goodrich Co.
Industrial Div.
Akron, Ohio.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Raybestos-Manhattan, Inc.
Manhattan Rubber Div.
Passaic, N. J.
Thor Power Tool Co.
35 North State St.
Aurora, Ill.
United States Rubber Co.
1230 Ave. of the Americas
New York 20, N. Y.

HOSE FITTINGS and REELS

B. F. Goodrich Co.
Industrial Div.
Akron, Ohio.
Hunt Valve Co.
1913 East State St.
Salem, Ohio.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

HOT BLAST EQUIPMENT (Cupola)

Brown Metals Inc. Corp.
300 Huron St.
Elyria, Ohio.
Modern Equipment Co.
Fort Washington, Wis.
Whiting Corp.
15607 Lathrop Ave
Harvey, Ill.

HYDRAULIC SYSTEM CONTROLS

The Oilgear Co.
1560 West Pierce St.
Milwaukee 4, Wis.

HYDROSTATIC TESTING EQUIPMENT

Steel City Testing Machines Inc.
8807 Lyndon Ave.
Detroit 38, Mich.

IDLERS (Conveyor)

Florida Conveyor & Equipment Co.
Mulberry, Fla.

IMPREGNATING SYSTEMS and CASTING SEALER

Hysol Corp.
Olean, N. Y.
Kirk White Chemical Co.
121 West Second St.
Oconomowoc, Wis.
Metallizing Co. of America
3520 W. Carroll Ave.
Chicago 24, Ill.
Tousey Varnish Co.
520 W. 25th St.
Chicago 16, Ill.

INGOT MOLDS

Acme Foundry Co.
2503 22nd St.
Detroit 16, Mich.
Great Lakes Carbon Corp.
18 E. 48th St.
New York 17, N. Y.
National Carbon Co. Div.
Union Carbide Corp.
39 East 42nd St.
New York 17, N. Y.
Speer Carbon Co.
St. Marys, Pa.

INGOT—(See type of metal)

INOCULANTS

Carborundum Co.
Niagara Falls, N. Y.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Great Lakes Carbon Corp.
18 E. 48th St.
New York 17, N. Y.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Ohio Ferro Alloys Corp.
Canton, Ohio.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
United States Graphite Co.
Saginaw, Mich.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

INSPECTION EQUIPMENT (Castings)

Allis-Chalmers
1123 S. 70th St.
Milwaukee 14, Wis.
Branson Instruments, Inc.
Brown House Rd.
Stamford, Conn.
Detroit Testing Machine Co.
9390 Grinnell Ave.
Detroit 13, Mich.
Dietert, Harry W., Co.
9330A Roselawn Ave.
Detroit 4, Mich.
Eastman Kodak Co.
Rochester, N. Y.
King Tester Corp.
440 North 13th St.
Philadelphia 23, Pa.
Magnaflux Corp.
7300 W. Lawrence Ave.
Chicago 31, Ill.
Picker X-Ray Corp.
25 S. Broadway
White Plains, N. Y.
Steel City Testing Machines Inc.
8807 Lyndon
Detroit 38, Mich.

INSTALLATION (Foundry Equipment)

Anchor Steel & Conveyor
6906 Kingsley Ave.
Dearborn, Mich.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
F. E. (North America) Ltd.
47 Advance Rd.
Toronto 18, Canada.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Taccone Corp.
Box E-512
North East, Pa.

IRON ALLOYS

Wal Met Alloys Co.
5320 Oakman Blvd.
Dearborn 2, Mich.

IRON ORE

Pickands Mather & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.

IRON OXIDES

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Tamms Industries Co.
228 N. LaSalle St.
Chicago 1, Ill.
Thiem Products Co.
9800 W. Rogers
Milwaukee 14, Wis.

IRON, PIG—See PIG IRON

IRON POWDER

Hoeganaes Sponge Iron Corp.
Riverton, N. J.

IRON (Sponge)

Hoeganaes Sponge Iron Corp.
Riverton, N. J.

JACKETS (Mold)

Adams Co.
Dubuque, Iowa.
Archer-Daniel-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
AWS Foundry Supplies & Eqt.
4727 South Hoyne Ave.
Chicago 9, Ill.
Fremont Flask Co.
Fremont, Ohio.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.

KEYS (Machine)

Standard Horse Nail Corp.
New Brighton, Pa.

KNOCKOUT MACHINES (Core)

Allis-Chalmers Mfg. Co.
Milwaukee 1, Wis.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Taccone Corp.
Box E-512
North East, Pa.

LABORATORY EQUIPMENT (Chemical)

Dietert, Harry W., Co.
9330A Roselawn Ave.
Detroit 4, Mich.
General Electric X-Ray Co.
4855 West Electric
Milwaukee 1, Wis.
Great Western Mfg. Co.
Leavenworth, Kans.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.

LABORATORY EQUIPMENT (Physical)

Baird-Atomic, Inc.
33 University Rd.
Cambridge 38, Mass.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Dietert, Harry W., Co.
9330A Roselawn Ave.
Detroit 4, Mich.
General Electric X-Ray Co.
4855 West Electric
Milwaukee 1, Wis.
Hevi-Duty Electric Co.
304 W. Hart St.
Watertown, Wis.
Gordon, Claud S., Co.
3000 S. Wallace
Chicago 16, Ill.
Great Western Mfg. Co.
Leavenworth Kans.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
Meltronics, Inc.
1010 North Main St.
Elkart, Ind.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Norton Co.
Worcester 6, Mass.

Steel City Testing Machines Inc.
8807 Lyndon Ave.
Detroit 38, Mich.

LADLES

Industrial Equipment Co.
Minster, Ohio.
Modern Equipment Co.
Port Washington, Wis.
Spincraft Inc.
4122 W. State St.
Milwaukee 8, Wis.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

LEAD

Federated Metals Div.
American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

LINERS (Shot Blast Equipment)

Pangborn Corporation
1400 Pangborn Blvd.
Hagerstown, Md.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

LINING MATERIAL (Rubber)

B. F. Goodrich Co.
Industrial Div.
Akron, Ohio.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

LIGHTERS (Cupola)

Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

LITHIUM

Lithium Corp. of America
500 Fifth Ave.
New York 36, N. Y.

LOADERS

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Clearfield Machine Co.
Clearfied, Pa.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Modern Equipment Co.
Port Washington, Wis.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.

LOADERS (Front-End)

Caterpillar Tractor Co.
Peoria, Ill.
Clark Equipment Co.
Industrial Truck Div.
Battle Creek, Mich.
Hough, Frank G., Co.
703 Sunnyside Ave.
Libertyville, Ill.
Towmotor Corp.
1226 East 152nd St.
Celveland 10, Ohio.
Yale & Towne Mfg. Co.
Roosevelt Blvd. & Haldeman Ave.
Philadelphia 15, Pa.

LUBRICANTS

Cities Service Oil Co.
20 N. Wacker Dr.
Chicago 6, Ill.
Dow Corning Corp.
Midland, Mich.
General Magnaplate Corp.
331 Main St.
Belleville, N. J.
Humble Oil & Refining Co.
P. O. Box 67
River Rouge Sta.
Detroit 15, Mich.
New York & New Jersey
Lubricant Co.
292 Madison Ave.
New York 17, N. Y.
Smith Oil & Refining Co.
1102 Kilburn Ave.
Rockford, Ill.
United Oil Mfg. Co.
Erie, Pa.
United States Graphite Co.
Saginaw, Mich.

LUBRICATORS (Air Line)

Airetool Mfg. Co.
Springfield, Ohio.
Bellows Div.
International Basic Foundry Corp.
P. O. Box 631
Akron 9, Ohio.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Tex.
Gardner Denver Co.
Gardner Drive
Quincy, Ill.
Hannifin Co.
Div. Parker Hannifin Corp.
637-D South Wolf Rd.
Des Plaines, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.

MAGNESIUM COMPOUNDS

Ohio Ferro Alloys Corp.
Canton, Ohio.
International Nickel Co.
67 Wall St.
New York 5, N. Y.
Vanadium Corp of America
420 Lexington Ave.
New York 17, N. Y.

MAGNESIUM INGOTS

Federated Metals Division of American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

MAGNETIC PARTICLE TESTING

Magnaflux Corp.
7300 W. Lawrence Ave.
Chicago 31, Ill.
Picker X-Ray Corp.
25 S. Broadway
White Plains 10, N. Y.

MAGNETS (Lifting)

Ohio Electric Mfg. Co.
5400 Dunham Rd.
Maple Heights, Ohio.

MANGANESE (Briquets)

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Ohio Ferro Alloys Corp.
Canton, Ohio.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 6, N. Y.

MATCHPLATE METAL

Federated Metals Division of American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

MATCHPLATES

Accurate Match Plate Co.
1847 W. Carroll St.
Chicago, Ill.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.
Midwest Pressure Casting Co.
1350 West Cermak Rd.
Chicago 8, Ill.
Moltrup Steel Products Co.
Beaver Falls, Pa.
Scientific Cast Products Corp.
1388-92 E. 40th St.
Cleveland 3, Ohio.

MEASURING and WEIGHING DEVICES

Baker Perkins, Inc.
Saginaw, Mich.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Gray Company, Inc.
60 11th Ave., Northeast
Minneapolis 13, Minn.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Steel City Testing Machines Inc.
8807 Lyndon
Detroit 38, Mich.
General Mills, Inc.
9200 Wayzata Blvd.
Minneapolis 26, Minn.

METAL CLEANING—See BLAST CLEANING EQUIPMENT

METER (Gas, Air, Water)

Alnor Instrument Co.
Div. Illinois Testing Laboratories, Inc.
420 N. LaSalle St.
Chicago 10, Ill.
Foxboro Company
Foxboro, Mass.

MILLING MACHINES

Cosa Corp.
405 Lexington Ave.
New York 17, N. Y.

MIXERS (Core Wash)

Archer-Daniels-Midland Co.
Federal Foundry Supply Division
2191 W. 110th St.
Cleveland 2, Ohio.

MOLD WASH—See WASH

MOLDING MACHINES (Green Sand)

Adams Co.
Dubuque, Iowa.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
British Moulding Machine Co. Ltd
Faversham, Kent, England.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Davenport Machine & Foundry Co.
Davenport, Iowa.
Eastern Clay Products Dept.
International Minerals & Chemicals Corp.
Old Orchard Rd.
Skokie, Ill.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Herman Pneumatic Machine Co.
Union Bank Bldg.
Pittsburgh 22, Pa.
International Molding Machine Co.
LaGrange Park, Ill.
Johnston & Jennings Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
SPO, Inc.
7500 Grand Division Ave.
Cleveland 25, Ohio.
Sinto Kogio, Ltd.
Showaku, Nagoya, Japan.
Sutter Products Co.
Hadley & Grant Sts.
Holly, Mich.
Tabor Mfg. Co.
Div. Turbo Machine Co.
Lansdale, Pa.
Taccone Corp.
Box E-512
North East, Pa.

MOLDING MACHINES (Shell Mold)

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
C & S Products Co.
18656 Fitzpatrick Ave.
Detroit 28, Mich.
Centrifugal Casting Machine Co.
Tulsa, Okla.
A. C. Chris Co.
1737 W. 91st St.
Chicago 20, Ill.
Demmler Mfg. Co.
Kewanee, Ill.
Dependable Pattern Works
1634 S. E. Seventh Ave.
Portland 14, Oreg.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada,
Harrison Machine Co.
2725 Station Rd.
Wesleyville Pa.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
SPO, Inc.
7500 Grand Division Ave.
Cleveland 25, Ohio.
Sutter Products Co.
Hadley & Grant Sts.
Holly, Mich.
Taccone Pneumatic Fdry. Eqt. Co.
P. O. Box 468
North East, Pa.

MOLDS (Permanent)

Central Pattern Co.
Quincy, Ill.
Centrifugal Casting Machine Co.
Tulsa, Okla.
Great Lakes Carbon Corp.
18 E. 48th St.
New York 17, N. Y.
National Carbon Co., Div.
Union Carbide Corp.
30 E. 42nd St.
New York 17, N. Y.
Permanent Mold Die Co.
2275 East 9 Mile Rd.
Hazel Park, Mich.
Taconne Corp.
Box E-512
North East, Pa.

MOLYBDENUM and COMPOUNDS

Whitehead Metals, Inc.
303 W. 10th St.
New York 14, N. Y.

MOTORS (Air, Hydraulic)

The Oilgear Co.
1560 West Pierce St.
Milwaukee 4, Wis.

MOTORS (Electric)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Ohio Electric Mfg. Co.
5400 Dunham Rd.
Maple Heights, Ohio.

MOTORS (Gear)

Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.

MULLERS—See SAND PREPARATION EQUIPMENT

NAILS (Foundry)

American Steel & Wire Div.
U. S. Steel Corp.
Rockefeller Bldg.
Cleveland 13, Ohio.
Standard Horse Nail Corp.
New Brighton, Pa.

NAILS (Wire)

American Steel & Wire Div.
U. S. Steel Corp.
Rockefeller Bldg.
Cleveland 13, Ohio.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.

NICKEL and NICKEL ALLOYS

International Nickel Co., Inc.
67 Wall St.
New York 5, N. Y.
Security Alloys Co.
3104 West 49th Place
Chicago 32, Ill.
Sheritt Gordon Mines Ltd.
25 West King St.
Toronto, Ontario, Canada.
Wai Met Alloys Co.
5320 Oakman Blvd.
Dearborn 2, Mich.
Whitehead Metals Inc.
303 W. 10th St.
New York 6, N. Y.

NITROGEN—See GAS

NOZZLES (Blasting, Spray)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3. Wis.
Norton Co.
Worcester 6, Mass.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Spraying Systems Co.
Bellwood, Ill.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

OIL, LINSEED—See BINDERS

OVENS (Annealing and Heat Treating) See FURNACES

OVENS (Core and Mold)

American Combustion Equipment Co.
614 Twelfth St., N. W.
Canton 3, Ohio.
Carl Mayer Corp.
20800 Center Ridge Rd.
Cleveland 16, Ohio.
Despatch Oven Co.
619 Eighth St., S. E.
Minneapolis 14, Minn.
Drying Systems, Inc.
1814 Foster Ave.
Chicago 40, Ill.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.
Hevi-Duty Electric Co.
2040 West Wisconsin Ave.
Milwaukee 1, Wis.
Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.
Lanly Company
2800 Euclid Ave.
Cleveland 15, Ohio.
Michigan Oven Co.
419 Brainard St.
Detroit 1, Mich.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.

OVENS (Enameling, Japanning)

Carl Mayer Corp.
20800 Center Ridge Rd.
Cleveland 16, Ohio.
Despatch Oven Co.
619 Eighth St., S. E.
Minneapolis 14, Minn.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.
Hevi-Duty Electric Co.
304 W. Hart St.
Watertown, Wis.
Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.
Lanly Co.
2800 Euclid Ave.
Cleveland 15, Ohio.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
Michigan Oven Co.
419 Brainard St.
Detroit 1, Mich.

OXYGEN—See GAS

PALLET BOXES (Wirebound)

Wirebound Box Mfg. Assoc.
222 West Adams St.
Chicago 6, Ill.

PARTING COMPOUNDS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Dow Corning Corp.
Midland, Mich.
Foseco Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Smith Oil & Refining Co.
1102 Kilburn Ave.
Rockford, Ill.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Superior Graphite Co.
33 S. Clark St.
Chicago 3, Ill.
Tamms Industries Co.
228 N. LaSalle St.
Chicago 1, Ill.
Thiem Products Co.
9800 W. Rogers
Milwaukee 14, Wis.
Whitehead Bros Co.
324 W. 23rd St.
New York 11, N. Y.

PASTE (Core)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Corn Products Co.
17 Battery Pl.
New York 4, N. Y.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Eastern Clay Products, Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
G. E. Smith, Inc.
246 Washington Rd.
Pittsburgh 16, Pa.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Superior Graphite Co.
33 South Clark St.
Chicago 3, Ill.
Thiem Products Co.
9800 W. Rogers
Milwaukee 14, Wis.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

PATTERN COATINGS

Foundry Rubber Inc.
5200 River Road
Washington 16, D. C.
National Chemical & Plastics Co.
1424 Philpot St.
Baltimore 31, Md.
Ren Plastics, Inc.
5422 South Cedar St.
Lansing 9, Mich.

PATTERN COMPOUND

Bestwall Gypsum Co.
120 East Lancaster Ave.
Ardmore, Pa.
Hysol Corp.
Olean, N. Y.
Ren Plastics, Inc.
5422 South Cedar St.
Lansing, Mich.
Tamms Industries Co.
228 N. LaSalle St.
Chicago 1, Ill.

PATTERN DRAW MACHINES—See STRIPPING and DRAWING MACHINES

PATTERN METAL

Federated Metals Division of American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

PATTERN SHOP EQUIPMENT

Chicago Wheel & Mfg. Co.
1101 W. Monroe
Chicago 7, Ill.
DoAll Co.
Des Plaines, Ill.
Oliver Machinery Company
Grand Rapids 1, Mich.
Tamms Industries Co.
228 N. LaSalle St.
Chicago 1, Ill.

PATTERNS and PATTERN PLATES (Wood, Metal, Plastic)

Accurate Match Plate Co.
1847 W. Carroll St.
Chicago, Ill.
Central Pattern Co.
Quincy, Ill.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Furane Plastics
4516 Brazil St.
Los Angeles 39, Calif.
Hines Flask Co.
3431 W. 140th St.
Cleveland 11, Ohio.
Moltrup Steel Products Co.
Beaver Falls, Pa.
Ronson, Marcel
56 Av. Brassine, Rhode St. Genese
Brussels, Belgium.
Scientific Cast Products Corp.
1388-92 E. 40th St.
Cleveland 3, Ohio.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

PEBBLES (Quartzside)

R. W. Sidley Co.
Thompson, Ohio.

PHOSPHOR COPPER

Federated Metals Division of American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

PHOTOGRAPHIC EQUIPMENT

Eastman Kodak Co.
Rochester, N. Y.
General Electric X-Ray Co.
4855 West Electric
Milwaukee 1, Wis.

PIG IRON

American Steel & Wire Div.
U. S. Steel Corp.
Rockefeller Bldg.
Cleveland 13, Ohio.
Hanna Furnace Corp.
Ecorse, Detroit 29, Mich.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Miller & Company
332 S. Michigan Ave.
Chicago 4, Ill.
Pickands Mather & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Pittsburgh Coke & Chemical Co.
Grant Bldg.
Pittsburgh 19, Pa.
Quebec Iron & Titanium Corp.
Sorel, Quebec, Canada
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Woodward Iron Co.
Woodward, Ala.

PIG IRON (Silver)

Hanna Furnace Corp.
Ecorse, Detroit 29, Mich.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Miller & Company
332 S. Michigan Ave.
Chicago 4, Ill.
Pickands Mather & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals, Inc.
303 West 10th St.
New York 14, N. Y.

PIG IRON (Spiegeleisen)

Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.

PINS (FLASK)—See FLASK FITTINGS, PINS and BUSHINGS

PITCH—See COREBINDERS (Pitch)

PLASTER

Bestwall Gypsum Co.
120 East Lancaster Ave.
Ardmore, Pa.

PLATES, CORE (Aluminum, Asbestos, Magnesium, Steel)

American Foundry Flask Co.
2745 Southwest Blvd.
Kansas City 8, Mo.
Chase Foundry & Mfg. Co.
2300 Parsons Ave.
Columbus 7, Ohio.
Johns-Manville
22 E. 40th St.
New York 16, N. Y.
Moltrup Steel Products Co.
Beaver Falls, Pa.
Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.
Sterling National Industries, Inc.
7036 W. Walker St.
Milwaukee 14, Wis.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

PLUGGERS

Tiffin Foundry Co.
West Adams St.
Tiffin, Ohio.

PLUMBAGO—See GRAPHITE and GRAPHITE BRIQUETS

PORTABLE POWER TOOLS

Airstool Mfg. Co.
Springfield, Ohio.
Aro Equipment Corp.
Byron, Ohio.
Chicago Mfg. & Distributing Co.
1928 W. 46th St.
Chicago 9, Ill.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Texas.
Gardner-Denver Co.
Quincy, Ill.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Krieg, Victor J., Inc.
1 Depot Plaza
Mamaroneck, New York.
Master Power Corp.
Sub. Black & Decker Corp.
6225 Cochran Rd.
Solon 39, Ohio.
Thor Power Tool Co.
Aurora, Ill.

POTS (Melting)

Acme Foundry Co.
2503 22nd St.
Detroit 16, Mich.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.

Tiffin Foundry Co.
West Adams St.
Tiffin, Ohio.

POURING DEVICES

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Cleveland Tramrail Div.
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Hawley Mfg. Co.
411 North Wabash
Wabash, Ind.
Industrial Equipment Co.
Minster, Ohio.
International Automation Corp.
Ann Arbor, Mich.
Modern Equipment Co.
Port Washington, Wis.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

PRESSES (Casting, Straightening and Trimming)

B & T Machinery Co.
Div. Greenlee Bros. & Co.
Rockford, Ill.
Hannifin Co.
Div. Parker-Hannifin Corp.
637-D South Wolf Road
Des Plaines, Ill.
Taccone Pneumatic Fdry. Eqt. Co.
P. O. Box 468
North East, Pa.

PRESSURE RECORDERS

Foxboro Company
Foxboro, Mass.

PULLEYS (Belt, Selfcleaning)

Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.

PULLEYS (Magnetic)—See SEPARATORS (Magnetic)

PUMPS (Liquid)

Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Gardner-Denver Co.
Quincy, Ill.
Gray Company, Inc.
60 11th Ave., Northeast
Minneapolis 13, Minn.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.
The Oilgear Co.
1560 West Pierce St.
Milwaukee 4, Wis.

PUMPS (Vacuum)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Ingersoll-Rand Co.
11 Broadway
New York 4, N. Y.

PUSH-OFF MACHINES—See STRIPPING, DRAWING and ROLLOVER MACHINES

PUTTY (Foundry)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.

PYROMETERS

Alnor Instrument Co.
Div. Illinois Testing Laboratories, Inc.
420 N. LaSalle St.
Chicago 10, Ill.
Foxboro Company
Foxboro, Mass.
Gordon, Claud S., Co.
3000 S. Wallace
Chicago 16, Ill.
Marshall Co., L. H.
270 W. Lane
Columbus 2, Ohio.
Tamms Industries Co.
228 N. LaSalle St.
Chicago 1, Ill.

RACKS (Core Oven)

AWS Foundry Supplies & Eqt.
4727 South Hoyne Ave.
Chicago 9, Ill.
Chase Foundry & Mfg. Co.
2300 Parsons Ave.
Columbus 7, Ohio.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.
Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.
Wadsworth Equipment Co.
2477 Mogadore Rd.
Akron, Ohio.

RADIOGRAPHIC EQUIPMENT

Budd Co.
Nuclear Systems Div.
2950 Roberts Ave.
Philadelphia 29, Pa.
Eastman Kodak Co.
Rochester, N. Y.
Picker X-Ray Corp.
25 S. Broadway
White Plains 10, N. Y.

REFRACTORIES (Firebrick, Fire Clay, Fire Sand, Fire Stone)

Ajax Magnethermic Corp.
3990 Simon Rd.
Youngstown 1, Ohio.
Allentown Pneumatic Gun Co.
1520 Walnut St.
Allentown, Pa.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Babcock & Wilcox Co.
161 42nd St.
New York 17, N. Y.
Campbell-Hausfeld Co.
Harrison, Ohio.
Carborundum Co.
Perth Amboy, N. J.
Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Great Western Mfg. Co.
Leavenworth, Kans.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

RIDDLES (Power)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Foundry Supplies & Mfg. Co.
2221 Orchard St.
Chicago 14, Ill.
Great Western Mfg. Co.
Leavenworth, Kans.
States Engineering Corp.
243 East Murray St.
Ft. Wayne, Ind.

RISER COMPOUND—See EXOTHERMIC COMPOUNDS

ROLLOVER MACHINES—See STRIPPING, DRAWING and ROLLOVER MACHINES

Cedar Heights Clay Co.
Oak Hill, Ohio.
Denver Fire Clay Co.
2301 Blake St.
Denver 2, Colo.
Eastern Clay Products Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
Great Lakes Carbon Co.
18 E. 48th St.
New York 17, N. Y.
A. P. Green Fire Brick Co.
Mexico, Mo.
Harbison-Walker Refractories Co.
307 Fifth Ave.
Pittsburgh 22, Pa.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Kaiser Refractories & Chemical Div.
300 Lakeside Drive
Oakland 12, Calif.
Inductotherm Corp.
412 Illinois Ave.
Delanco, N. J.
Ironton Fire Brick Co.
Ironton, Ohio.
Johns-Manville
22 E. 40th St.
New York 16, N. Y.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
National Carbon Co., Div.
Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.
North American Refractories Co.
East 6th National City Bank Bldg.
Cleveland 14, Ohio.
Norton Co.
Worcester 6, Mass.
Frederic B. Stevens, Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Chas. Taylor Sons Co.
710 Burns St.
Cincinnati 4, Ohio.
United States Graphite Co.
Saginaw, Mich.
Whitehead Bros Co.
324 W. 23rd St.
New York 11, N. Y.

REFRACTORY GUNS

Allentown Pneumatic Gun Co.
1520 Walnut St.
Allentown, Pa.
Eastern Clay Products Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Ridley & Co., Inc.
11275 Massachusetts Ave.
West Los Angeles 25, Calif.

RELEASE AGENTS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Dow Corning Corp.
Midland, Mich.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
United Oil Mfg. Co.
Erie, Pa.

RESIN—See BINDERS

RESPIRATORS

American Optical Co.
Southbridge, Mass.
Pangborn Corporation
1400 Pangborn Blvd.
Hagerstown, Md.

RIDDLES (Hand)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.

ROPE (Wire)

American Chain & Cable Co., Inc.
271 S. Pennsylvania Ave.
Wilkes-Barre, Pa.

SAFETY EQUIPMENT

American Optical Co.
Southbridge, Mass.
Bausch & Lomb Inc.
635 St. Paul St.
Rochester 2, N. Y.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
United States Rubber Co.
1230 Ave. of the Americas
New York 20, N. Y.

SAND (Carbon)

Humble Oil & Refining Co.
P. O. Box 67
River Rouge Sta.
Detroit 18, Mich.

SAND (Core, Molding, Blasting)

Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Great Lakes Foundry Sand Co.
1217 Francis Palms Bldg.
Detroit 1, Mich.
Harbison-Walker Refractories Co.
307 Fifth Ave.
Pittsburgh 22, Pa.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Metal & Thermit Corp.
Orefraction Div.
Rahway, N. J.
Orefraction Inc.
Andrews, South Carolina.
Ottawa Silica Co.
Ottawa, Ill.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Pennsylvania Glass Sand Corp.
140 Stanwix St.
Pittsburgh 22, Pa.
Standard Silica Co.
Ottawa, Ill.
Wedron Silica Co.
135 S. LaSalle St.
Chicago 3, Ill.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

SAND (Resin Coated)

Aurora Metal Co.
Aurora, Ill.
Sutler Products Co.
Hadley & Grand Sts.
Holly, Mich.

SAND (Zircon)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 100th St.
Cleveland 2, Ohio.
Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Metal & Thermit Corp.
Orefraction Div.
Rahway, N. J.
G. E. Smith, Inc.
246 Washington Rd.
Pittsburgh 16, Pa.
Berkshire Chemicals, Inc.
630 Third Ave.
New York 17, N. Y.
Carpenter Brothers, Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Orefraction Inc.
Andrews, South Carolina.

SAND ADDITIVES

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Baroid Chemicals Inc.
Sub. National Lead Co.
P. O. Box 1675
Houston 2, Tex.
Cedar Heights Clay Co.
Oak Hill, Ohio.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Eastern Clay Products Div.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
Hickman Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
G. E. Smith, Inc.
246 Washington Rd.
Pittsburgh 16, Pa.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

SAND BLAST EQUIPMENT—See BLAST CLEANING EQUIPMENT

SAND BLAST NOZZLES—See NOZZLES (Blasting)

SAND CONTROL and TESTING EQIUPMENT

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.

Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Dietert, Harry W., Co.
9330A Roselawn Ave.
Detroit 4, Mich.
Gordon, Claud S., Co.
3000 S. Wallace
Chicago 16, Ill.
Great Western Mfg. Co.
Leavenworth, Kans.
Hartley Controls Corp.
P. O. Box 290
Neenah, Wis.
JEM Laboratories, Inc.
1108 West 5th St.
Ashtabula, Ohio.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.

SAND PREPARATION EQUIPMENT

Ajax Flexible Coupling Co. Inc.
Westfield, N. Y.
Allis-Chalmers Mfg Co.
1123 S. 70th St.
Milwaukee 14, Wis.
American Air Filter Co.
226 Central Ave.
Louisville 8, Ky.
Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Baker Perkins, Inc.
Saginaw, Mich.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
C & S Products Co.
18656 Fitzpatrick Ave.
Detroit 28, Mich.
Carrier Conveyor Div.
Chain Belt Co.
211 N. Jackson St.
Louisville 2, Ky.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Clearfield Machine Co.
Clearfield, Pa.
Cleveland Tramrail Div.
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Dietert, Harry W., Co.
9330A Roselawn Ave.
Detroit 4, Mich.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Foundry Supplies & Mfg. Co.
2221 Orchard St.
Chicago 14, Ill.
B. F. Goodrich Co.
Industrial Div.
Akron, Ohio.
Great Western Mfg. Co.
Leavenworth, Kans.
Hartley Controls Corp.
P. O. Box 290
Neenah, Wis.
International Automation Corp.
Ann Arbor, Mich.
International Foundry Supply Co.
Water & Spruce Sts.
Reading, Pa.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
The Moulders' Friend
Dallas City, Ill.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Newaygo Engineering Co.
Newaygo, Mich.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
Pekay Machine & Engineering Co.
2510 W. Lake St.
Chicago 12, Ill.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Royer Foundry & Machine Co.
Kingston, Pa.
States Engineering Corp.
243 East Murray St.
Ft. Wayne 2, Ind.
Sutter Products Co.
Hadley & Grant Sts.
Holly Mich.
Webster Mfg. Co.
Tiffin, Ohio.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

SAND RAMMERS

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Texas.
Gardner-Denver Co.
Gardner Drive
Quincy, Ill.
Ingersoll Rand Co.
11 Broadway
New York 4, N. Y.
Master Power Corp.
Sub. Black & Decker Corp.
6225 Cochran Rd.
Solon 39, Ohio.
Thor Power Tool Co.
35 North State St.
Aurora, Ill.

SAND RAMMING MACHINES (Slinger Type)

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
F. E. (North America) Ltd.
47 Advance Rd.
Toronto 18, Ontario, Canada.

SAND RECLAIMING EQUIPMENT

Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
International Foundry Supply Co.
Water & Spruce Sts.
Reading, Pa.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
KFW Corp.
2130 Dime Bank Bldg.
Detroit 26, Mich.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Nichols Engineering & Research Corp.
70 Pine St.
New York 5, N. Y.
Sinto Kogio, Ltd.
Showaku, Nagoya, Japan.
Stearns Magnetic Products Div.
Indiana Steel Products Co.
635 South 28th St.
Milwaukee 46, Wis.

SAND SIFTING and SCREENING MACHINERY—See SAND PREPARATION EQUIPMENT

SAND STABILIZER

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Baroid Chemicals Inc.
Sub. National Lead Co.
P. O. Box 1675
Houston 2, Texas.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Reichhold Chemicals, Inc.
525 N. Broadway
White Plains, N. Y.

SANDING MACHINERY (Disc, Spindle, Belt, etc.)

DoAll Co.
Des Plaines, Ill.
Oliver Machinery Company
Grand Rapids 1, Mich.

SAWS and ACCESSORIES

Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Oliver Machinery Co.
Grand Rapids 1, Mich.

SCREENS (Shakeout, Vibrating and Rotary)

Ajax Flexible Coupling Co., Inc.
Westfield, N. Y.
Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Bartlett & Snow, C. O., Co.
6201 Harvard Ave.
Cleveland 5, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Carrier Conveyor Div.
Chain Belt Co.
211 N. Jackson St.
Louisville 2, Ky.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Great Western Mfg. Co.
Leavenworth, Kans.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Stephens-Adamson Mfg. Co.
Aurora, Ill.

SEA COAL

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Penn-Rilton Co.
324 W. 23rd St.
New York 11, N. Y.
Stevens, Frederic B., Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Thiem Products Co.
9800 W. Rogers
Milwaukee 14, Wis.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

SEALING COMPOUND (Mold)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Whitehead Bros. Co.
324 W. 23rd St.,
New York 11, N. Y.

SEPARATORS (Compressed Air Contaminant)—See FILTERS and SEPARATORS

SEPARATORS (Magnetic)

Ajax Flexible Coupling Co. Inc.
Westfield, N. Y.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Homer Mfg. Div.
Ohio Electric Mfg. Co.
142 East Pearl St.
Lima, Ohio.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
National Engineering Co.
549 W. Washington St.
Chicago 6, Ill.
Ohio Electric Mfg. Co.
5400 Dunham Rd.
Maple Heights, Ohio.
Stearns Magnetic Products Div.
Indiana Steel Products Co.
635 South 28th St.
Milwaukee 46, Wis.

SHAKEOUT MACHINERY

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
American Air Filter Co.
226 Central Ave.
Louisville 8, Ky.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
The Branford Co.
132 Glen St.
New Britain, Conn.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Royer Foundry & Machine Co.
Kingston, Pa.
Simplicity Engineering Co.
Durand, Mich.
Taccone Corp.
Box E-512
North East, Pa.
Webster Mfg. Co.
Tiffin, Ohio.

SHELL MOLDING—See
MOLDING MACHINES (Green Sand)
BINDERS, CORE AND MOLD (Resin)
MOLDING MACHINES (Shell Mold)
SAND (Resin Coated)

SHELVING (Prefabricated Steel)

Republic Steel Corp.
Republic Bldg.
Cleveland 1, Ohio.

SHOT and GRIT (Metallic)

Alloy Metal Abrasive Co.
121 S. Division St.
Ann Arbor, Mich.
Archer Daniels Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2,Ohio.
Carpenter Bros., Inc.
606 West Wisconsin
Milwaukee 3, Wis.
Cleveland Metal Abrasive Co.
887 E. 67th St.
Cleveland, Ohio.
Globe Steel Abrasive Co.
Mansfield, Ohio.
Hickman-Williams & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Metal Blast, Inc.
871 E. 67th St.
Cleveland, Ohio
National Metal Abrasive Co.
3560 Norton Ave.
Cleveland 7, Ohio.
Pangborn Corp.
1400 Pangborn Blvd.
Hagerstown, Md.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

SHOT TESTING MACHINES

Alloy Metal Abrasive Company
121 S. Division St.
Ann Arbor, Mich.

SHOVELS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Stevens, Frederic B., Inc.
18th St. & Vernor Highway
Detroit 16, Mich.

SHOVELS (Power)

Clark Equipment Co.
Industrial Truck Div.
Battle Creek, Mich.
Hough, Frank G., Co.
703 Sunnyside Ave.
Libertyville, Ill.

SILICOMANGANESE

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Ohio Ferro Alloys Corp.
Canton, Ohio.

Pickands Mather & Co.
Union Commerce Bldg.
Cleveland 14, Ohio.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

SILICON (Briquets)

Keokuk Electro Metals Co.
320 Concert St.
Keokuk, Iowa.
Ohio Ferro Alloys Corp.
Canton 9, Ohio.
Union Carbide Metals Co.
Div. Union Carbide Corp.
270 Park Ave.
New York 17, N. Y.
Vanadium Corp. of America
420 Lexington Ave.
New York 17, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

SKIMMERS

Spincraft Inc.
4122 W. State St.
Milwaukee 8, Wis.
Tamms Industries Co.
228 N. LaSalle St.
Chicago 1, Ill.

SLINGS (Chain)—See CHAIN

SMELTERS and REFINERS

Federated Metals Div., American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

SNAGGING MACHINES—See GRINDERS

SNAGGING WHEELS—See GRINDING WHEELS

SODA ASH

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Diamond Alkali Co.
300 Union Commerce Bldg.
Cleveland 14, Ohio.
Hercules Powder Co.
Wilmington 99, Del.
Olin Mathieson Chemical Corp.
400 Park Ave.
New York, N. Y.

SODIUM SILICATE—See BINDERS

SOLDER

Federated Metals Div., American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.
Whitehead Metals Inc.
303 W. 10th St.
New York 14, N. Y.

SPECTROGRAPHIC ANALYSIS (Equipment and Materials)

Applied Research Laboratories
P. O. Box 1710
Glendale 5, Calif.
Baird-Atomic, Inc.
33 University Rd.
Cambridge 38, Mass.

SPEED REDUCERS

Anchor Steel & Conveyor Co.
6906 Kinksley Ave.
Dearborn Mich.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.

SPRAY GUNS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
The Branford Co.
132 Glen St.
New Britain, Conn.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Metallizing Co. of America
3520 W. Carroll Ave.
Chicago 24, Ill.
James A. Murphy & Co.
Hamilton, Ohio.
Spraying Systems Co.
Bellwood, Ill.

SPRUE CUTTERS and FORMERS

Adams Co.
Dubuque, Iowa.
Beardsley & Piper
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Meldau Tool Co.
2524 South 61st Ave.
Cicero, Ill.
Milwaukee Chaplet & Mfg. Co.
1023 S. 40th St.
Milwaukee, Wis.
Taccone Corp.
Box E-812
North East, Pa.

STEEL (Structural)

American Bridge Div.
United States Steel Corp.
52 S. Wm. Penn Pl.
Pittsburgh 19, Pa.

STRAIGHTENERS and CUTTERS (Core Rod)

Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Wheelabrator Corp.
505 S. Byrkit St.
Mishawaka, Ind.

STRAINER (Liquid Line)

Spraying Systems Co.
Bellwood, Ill.

STRAINER CORES—See CORES (Strainer, Riser, Breakoff)

STRIPPING, DRAWING and ROLLOVER MACHINES

The Adams Co.
Dubuque, Iowa.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
British Moulding Machine Co., Ltd.
Faversham, Kent, England.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Davenport Machine & Fdry Co.
Davenport, Iowa.
F. E. (North America) Ltd.
47 Advance Road
Toronto 18, Canada.
International Molding Machine Co.
LaGrange Park, Ill.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
Sutter Products Co.
Hadley & Grant Sts.
Holly, Mich.
Tabor Mfg. Co.
Div. Turbo Machine Co.
Lansdale, Pa.
Taccone Corp.
P. O. Box E-512
North East, Pa.

SUPPLY HOUSES (Foundry)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Bruce, Vince, Inc.
5345 Lexington Ave.
Indianapolis 7, Ind.
Combined Supply & Equipment Co.
Inc. 215 Chandler St.
Buffalo 7, N. Y.
Eastern Clay Products Dept.
International Minerals & Chemical Corp.
Old Orchard Rd.
Skokie, Ill.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
Stevens, Frederic B., Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Thiem Products Co.
9800 W. Rogers
Milwaukee 14, Wis.

TABLES

Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Nomad Equipment Corp.
3110 W. Fond du Lac Ave.
Milwaukee 10, Wis.

TELLURIUM

American Smelting & Refining Co.
120 Broadway
New York 5, N. Y.

TEMPERATURE CONTROL and RECORDING EQUIPMENT

Alnor Instrument Co.
Div. Illinois Testing Laboratories, Inc.
420 N. LaSalle St.
Chicago 10, Ill.
Foxboro Co.
Foxboro, Mass.
Gordon, Claud S., Co.
3000 S. Wallace
Chicago 16, Ill.
Lindberg Engineering Co.
Fisher Furnace Div.
2450 W. Hubbard
Chicago 12, Ill.
Marshall Co., L. H.
270 W. Lane
Columbus 2, Ohio.

TENSILE TESTING MACHINES

Detroit Testing Machine Co.
9390 Grinnell Ave.
Detroit 13, Mich.
Dietert, Harry W., Co.
9330A Roselawn Ave.
Detroit 4, Mich.
Steel City Testing Machines Inc.
8807 Lyndon
Detroit 38, Mich.

TESTING EQUIPMENT—See Type of Test

THERMOCOUPLES

Alnor Instrument Co.
Div. Illinois Testing Laboratories, Inc.
420 N. LaSalle St.
Chicago 10, Ill.
Gordon, Claud S., Co.
3000 S. Wallace
Chicago 16, Ill.
Marshall Co., L. H.
270 W. Lane
Columbus 2, Ohio.
Tamms Industries Co.
228 N. LaSalle St.
Chicago 1, Ill.
Tiffin Foundry Co.
West Adams St.
Tiffin, Ohio.

TILE (Gate)

Ferro Corp.
Louthan Div.
East Liverpool, Ohio.
Universal Clay Products
Sandusky, Ohio.

TIMERS (Electric)

Arcair Co.
465 S. Mt. Pleasant St.
Lancaster, Ohio.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Herman Pneumatic Machine Co.
Union Bank Bldg.
Pittsburgh 22, Pa.

TIN

Federated Metals Div., American Smelting and Refining Co.
120 Broadway
New York 5, N. Y.

TIRES (Industrial)

United States Rubber Co.
1230 Ave. of the Americas
New York 20, N. Y.

TITANIUM SLAG

Quebec Iron & Titanium Corp.
Sorel, Quebec, Canada

TONGS

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Industrial Equipment Co.
Minster, Ohio.

TORCHES and BURNERS (Acetylene, Gas, Oil)

Johnston Mfg. Co.
2825 E. Hennepin Ave.
Minneapolis 13, Minn.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.

TORCHES (Metal Removal)

Arcair Co.
465 South Mt. Pleasant Ave.
Lancaster, Ohio.

TRACTORS—See TRUCKS (Utility and Power Lift)

TRANSVERSE TESTING MACHINES

Pasadena Hydraulic Inc.
1433 Lindcombe St.
El Monte, Calif.
Steel City Testing Machines Inc.
8807 Lyndon
Detroit 38, Mich.

TROLLEYS

Anchor Steel & Conveyor Co.
6906 Kingsley Ave.
Dearborn, Mich.
Cleveland Tramrail Div.
Cleveland Crane & Engineering Co.
1155 E. 283rd St.
Wickliffe, Ohio.
Curtis Pneumatic Machinery Div.
Curtis Mfg. Co.
1905 Kienlen Ave.
St. Louis 20, Mo.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Modern Equipment Co.
Port Washington, Wis.
Planet Corp.
P. O. Box 7
Lansing 1, Mich.
Yale & Towne Mfg. Co.
Roosevelt Blvd. & Haldeman Ave.
Philadelphia 15, Pa.

TRUCK CRANES

Drott Mfg. Co.
3126 South 27th St.
Milwaukee 15, Wis.
Elwell-Parker Electric Co.
4205 St. Clair Ave.
Cleveland 3, Ohio.
Towmotor Corp.
1226 East 152nd St.
Cleveland 10, Ohio.

TRUCKS (Core)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
AWS Foundry Supplies & Eqt.
4727 South Hoyne Ave.
Chicago 9, Ill.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Chase Foundry & Mfg. Co.
2300 Parsons Ave.
Columbus 7, Ohio.
Foundry Equipment Co.
1831 Columbus Rd.
Cleveland 13, Ohio.
Kirk & Blum Mfg. Co.
3108 Forrer St.
Cincinnati 9, Ohio.

Sterling National Industries, Inc.
7036 W. Walker St.
Milwaukee 14, Wis.

TRUCKS (Dump)

Chase Foundry & Mfg. Co.
2300 Parsons Ave.
Columbus 7, Ohio.

TRUCKS (Utility and Power Lift)

Allis-Chalmers Mfg. Co.
1123 S. 70th St.
Milwaukee 14, Wis.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Clark Equipment Co.
Industrial Truck Div.
Battle Creek, Mich.
Elwell-Parker Electric Co.
4205 St. Clair Ave.
Cleveland 3, Ohio.
Hough, Frank G., Co.
703 Sunnyside Ave.
Libertyville, Ill.
Nomand Equipment Corp.
3110 West Fond du Lac Ave.
Milwaukee 10, Wis.
Ready Power Co.
3826 Grand River Ave.
Detroit 8, Mich.
Sterling National Industries, Inc.
7036 W. Walker St.
Milwaukee 14, Wis.
Towmotor Corp.
1226 East 152nd St.
Cleveland 10, Ohio.
Yale & Towne Mfg. Co.
Roosevelt Blvd. & Haldeman Ave.
Philadelphia 15, Pa.

TUMBLING BARRELS

United States Rubber Co.
1230 Ave. of the Americas
New York 20, N. Y.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

TUMBLING STARS

Quincy Foundry Inc.
Quincy, Ohio.

TURNTABLES

Anchor Steel & Conveyor Co.,
6906 Kingsley Ave.
Dearborn, Mich.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Chase Foundry & Mfg. Co.
2300 Parsons Ave.
Columbus 7, Ohio.
F. E. (North America) Ltd.
47 Advance Rd.
Toronto 18, Canada.
Modern Equipment Co.
Port Washington, Wis.
Newaygo Engineering Co.
Newaygo, Mich.
Nomad Equipment Corp.
3110 West Fond du Lac Ave.
Milwaukee 10, Wis.
Stephens-Adamson Mfg. Co.
Aurora, Ill.
Taccone Corp.
P. O. Box E-512
North East, Pa.
Whiting Corp.
15607 Lathrop Ave.
Harvey, Ill.

UNLOADERS (Car)

Jeffery Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.

VACUUM CLEANERS

Spencer Turbine Co.
Hartford, Conn.

VALVES (Blow-off and Cut-off)

Bellows Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.
Champion Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Tex.
Hannifin Co.
Div. Parker-Hannifin Corp.
637-D South Wolf Road
Des Plaines, Ill.
Hunt Valve Co.
1913 East State St.
Salem, Ohio.
S P Mfg. Corp.
20301 Aurora Rd.
Solon, Ohio.
Valvair Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.

VALVES (Gas, Oil, Water, Steam)

Bellows Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.
Cleco Div.
Reed Roller Bit Co.
5125 Clinton Drive
Houston 20, Tex.
Hannifin Co.
Div. Parker-Hannifin Corp.
637-D South Wolf Road
Des Plaines, Ill.
Hunt Valve Co.
1913 East State St.
Salem, Ohio.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.
The Oilgear Co.
1560 West Pierce St.
Milwaukee 4, Wis.
S P Mfg. Corp.
20301 Aurora Rd.
Solon, Ohio.
Valvair Div.
International Basic Economy Corp.
P. O. Box 631
Akron 9, Ohio.

VENTILATING, EXHAUST & COOLING EQUIPMENT

Bartlett & Snow, C. O., Co.
(Grindle Div)
6201 Harvard Ave.
Cleveland 5, Ohio.
Brown Metals Inc.
300 Huron St.
Elyria, Ohio.
Fly Ash Arrestor Corp.
P. O. Box 1883
Birmingham 3, Ala.
Hawley Mfg. Co.
411 North Wabash
Wabash, Ind.
Joy Mfg. Co.
Henry W. Oliver Bldg.
Pittsburgh 22, Pa.
Claude B. Schneible Co.
P. O. Box 296, Roosevelt Park
Detroit 32, Mich.

VENTS (Core)

Bruce, Vince, Inc.
5345 Lexington Ave.
Indianapolis 7, Ind.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Demmler Mfg. Co.
Kewanee, Ill.
Domestic Industries
470 West Broad St.
Columbus 22, Ohio.
Martin Engineering Co.
Neponset, Ill.
Smillie, C. M., & Co.
1124 Woodward Heights Blvd.
Ferndale 20, Mich.

VENTS (Corebox)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Bruce, Vince, Inc.
5345 Lexington Ave.
Indianapolis 7, Ind.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Demmler Mfg. Co.
Kewanee, Ill.
Monarch Products Corp.
960 West 122nd St.
Chicago 43, Ill.
Smillie, C. M., & Co.
1124 Woodward Heights Blvd.
Ferndale 20, Mich.

VIBRATORS

Adams Co.
Dubuque, Iowa.
Beardsley & Piper Div.
Pettibone Mulliken Corp.
2424 N. Cicero Ave.
Chicago 39, Ill.
Branford Co., The
132 Glen St.
New Britain, Conn.
British Moulding Machine Co. Ltd.
Faversham, Kent, England.
Chicago Pneumatic Tool Co.
6 E. 44th St.
New York 17, N. Y.
Cleveland Vibrator Co.
2828 Clinton Ave.
Cleveland 13, Ohio.
Davenport Machine & Foundry Co.
Davenport, Iowa.
Foundry Supplies & Mfg. Co.
2221 Orchard St.
Chicago 14, Ill.
Herman Pneumatic Machine Co.
Union Bank Bldg.
Pittsburgh 22, Pa.
International Molding Machine Co.
LaGrange Park, Ill.
Jeffrey Mfg. Co.
907 N. Fourth St.
Columbus 16, Ohio.
Link-Belt Co.
Dept. 1059-FWTB
Prudential Plaza
Chicago 1, Ill.
Martin Engineering Co.
Neponset, Ill.
National Air Vibrator Co.
435 Literary Ave.
Cleveland 13, Ohio.
Osborn Mfg. Co.
5401 Hamilton Ave.
Cleveland 14, Ohio.
SPO, Inc.
7500 Grand Division Ave.
Cleveland 25, Ohio.
Stevens, Frederic B., Inc.
18th St. & Vernor Highway
Detroit 16, Mich.
Tabor Mfg. Co.
Div. Turbo Machine Co.
Lansdale, Pa.

VISES (Hydraulic, Mechanical, etc.)

American Foundry Flask Co.
2748 Southwest Blvd.
Kansas City 8, Mo.
Desmond-Stephan Mfg. Co.
Urbana, Ohio.

WASH (Core and Mold)

Archer-Daniels-Midland Co.
Federal Foundry Supply Div.
2191 W. 110th St.
Cleveland 2, Ohio.
Carver Foundry Products Co.
1056 Hershey Ave.
Muscatine, Iowa.
Cities Service Oil Co.
20 N. Wacker Dr.
Chicago 6, Ill.
Corn Products Co.
17 Battery Pl.
New York 4, N. Y.
Delta Oil Products Co.
6263 Cedarburg Rd.
Milwaukee 9, Wis.
Foundry Rubber Inc.
5200 River Road
Washington 16, D. C.
Foseco, Inc.
P. O. Box 8728
Cleveland 35, Ohio.
National Carbon Div.
Union Carbide Corp.
30 East 42nd St.
New York 17, N. Y.
Pennsylvania Pulverizing Co.
140 Stanwix St.
Pittsburgh 22, Pa.
Smith Oil & Refining Co.
1102 Kilburn Ave.
Rockford, Ill.
G. E. Smith, Inc.
246 Washington Rd.
Pittsburgh 16, Pa.
Stevens, Frederic B., Inc.
18th St. & Vernor Highway
Detroit 26, Mich.
Superior Graphite Co.
33 South Clark St.
Chicago 3, Ill.
Thiem Products Co.
9800 W. Rogers
Milwaukee 14, Wis.
United Oil Mfg. Co.
1429 Walnut St.
Erie, Pa.
United States Graphite Co.
Saginaw, Mich.
Whitehead Bros. Co.
324 W. 23rd St.
New York 11, N. Y.

WEDGES (Foundry)

Adams Co.
Dubuque, Iowa.
AWS Foundry Supplies & Eqt.
4727 South Hoyne Ave.
Chicago 9, Ill.

WELDING APPARATUS (Electric Arc, Inert Gas)

Harnischfeger Corp.
4400 West National Ave.
Milwaukee 46, Wis.
Liquid Carbonic Div.
General Dynamics Corp.
135 S. LaSalle St.
Chicago 3, Ill.
Metallizing Co. of America
3520 W. Carroll Ave.
Chicago 24, Ill.
Miller Electric Mfg. Co.
Appleton, Wis.
Rexarc, Inc.
West Alexandria, Ohio.

WELDING GAS—See GAS

WELDING RODS—See ELECTRODES and RODS

WHEELBARROWS

Sterling National Industries, Inc.
7036 W. Walker St.
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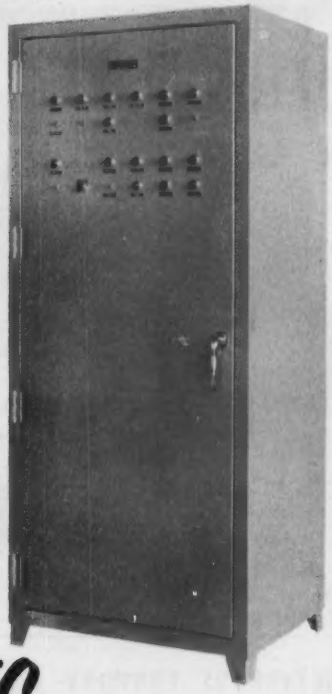
A VASTLY IMPROVED CONTROLLER



DOES ALL THIS!--

- Charges 95% of required water into mixer at same time as material
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These notable advantages are achieved by a patented device which operates in conjunction with a new procedural concept in the addition of water to the mixer. Results are guaranteed. Complete details of the all-new Hartley Series XVI sand controller will be supplied promptly upon request.

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For More Information Circle 784, Page 39

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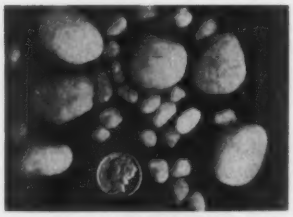

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By A. J. Murphy

Covers the general principles unifying foundry techniques of all industrial nonferrous metals in relation to metals in the liquid state to the process of solidification and to the factors influencing properties of casting. Other materials include the part played by gas dissolved in liquid metals, its control and its influence on cast products, factors influencing the grain size of castings, and mechanical properties of castings as complete components compared with the properties in conventional test samples.

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Progressive mechanized malleable and ductile iron foundry, serving New York, Pennsylvania and Ohio area, looking for foundry and sales engineers capable of aggressive selling and casting design engineering. Age 30 to 40 years. Send all details including recent photograph. Replies in strict confidence.

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($8,000 to $10,000)

For a modern foundry. Client assumes the employment fee. Contact Paul Sheldon in confidence.

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Must be capable of managing and running a pattern shop completely.

Must be experienced in wood and metal pattern work, as well as shell pattern and shell core boxes. This is a growing situation.

Must be capable of building the operation, hiring and training personnel, and be responsible for all phases of running this business.

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Thorough knowledge of rigging patterns for production. Knowledge of steel and iron risering; sand practice application and core-blowing important. Steel risering experience a must.

GUNITE FOUNDRIES DIVISION
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Degree in Metallurgy, experience in melting carbon, alloy and stainless steels in arc and induction furnaces, processing, heat treating, and general quality control in modern Eastern steel foundry producing castings in the 20 lb. class. Address: Box 866, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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SMALL GRAY IRON FOUNDRY NEAR CHICAGO, MUST HAVE EXPERIENCE IN MOLDING AND MELTING OF GRAY IRON AND DUCTILE. MUST HAVE RECOMMENDATIONS. ADDRESS: BOX 901, FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

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ENGINEER

Fourteen years' diversified experience in the field of foundry operation and engineering. Age 37. Interested in a responsible position of foundry engineer, plant engineer or foundry equipment designer. Address: Box 907, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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25 years' diversified experience in all types of ferrous metals. Large and small, production or jobbing. Administrative, technical and practical training. Capable consultant. Excellent labor relations and references. Now employed. Age 47. Address: Box 905, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR GENERAL FOREMAN

Twenty-five years' supervisory experience in steel foundry jobbing and production. Includes carbon, alloy, and stainless steel—pressure and X-ray castings: Quality control, molding, melting, coremaking, cleaning, heat treating, sand mixtures, gates and risers. Address: Box 900, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CORE ROOM FOREMAN

Age 40. Twenty-two years' experience in iron and steel foundries. Fourteen years as a supervisor. Have also had schooling for supervision. Desire job with a future. Address: Box 890, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALES

Graduate engineer. Mid thirties. Supervisory experience in manufacturing and sales of ferrous castings. Prefer Midwest location and steel castings but will consider any offer. Address: Box 909, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT—GENERAL FOREMAN

Practical and technical; presently employed in the East; over 30 years' experience; jobbing or production to 5 tons. Address: Box 904, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN

Experienced in gray iron and nonferrous metals, mechanization, design, patternmaking, gating, risering, costs. Presently employed as pattern supervisor. Address: Box 867, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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93% of casting buyers rate quality as the first criteria influencing where they purchase. M.I.T. graduate in Metallurgical Engineering with 12 years' experience meeting strict quality requirements. Have demonstrated record of effectiveness in technical and managerial positions resulting in substantial quality cost improvements in production of all sizes steel, iron and nonferrous castings. Seeking challenging management responsibility. Address: Box 873, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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• POSITIONS WANTED

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Experienced in all phases of quality control and acid electric steel foundry and nonferrous foundry. Age 31. Will relocate. Address: Box 908, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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Have 25 years' experience in brass foundry casting complete line of plumbing castings. Capable of taking complete charge of all foundry operations. Have 15 years' as foundry Superintendent—still working in that capacity. Address: Box 885, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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With good profit record would like to make change. Will relocate. Address: Box 903, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

POSITION WANTED

Time Study and Methods Engineer. Seventeen years' experience; twelve years in C.I. and D.I. foundry. Do all estimating. Eight years as department head. Now Employed. Desire relocation and chance to advance. Resume on request. Address: Box 880, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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Twenty-six years' practical and technical experience in jobbing and production foundries in Europe and U. S. A. 14 years' supervision and troubleshooting. Age 43. Prefer nonferrous. Resume on request. Address: Box 911, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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Technically, practically and administratively experienced in producing grey iron, ductile, malleable and steel. Presently employed. Will consider overseas assignment. Address: Box 882, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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Hard-driving and versatile foundryman desires demanding position as manager's assistant or superintendent. Fourteen years of diversified gray iron jobbing and production experience. Journeyman. Engineer graduate with added business education. Young familyman. Will go anywhere.

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SUPERINTENDENT—CLEANING ROOM

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REPRESENTATIVES WANTED

Jobbing gray iron and aluminum foundry in Central Pennsylvania area desires sales representation in that area plus the Pittsburgh, Philadelphia and Baltimore areas. Please state experience, current representation and area covered.

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OPEN CAPACITY WANTED
C & D and Loose Pattern Work—Machinery and Municipal, 75 to 20,000 lb.—tensile 30 to 35,000. 5 to 20 tons weekly. Must be within 200 miles of St. Louis.
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Foundry investment organization needs used equipment to activate and mechanize a large foundry. Complete foundry with or without property will be considered. Please be specific as to price and when inspection can be made. Principals only. All replies confidential.
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FOR SALE
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FOUNDRY FOR SALE
Fully equipped now operating gray iron foundry in Western New York State for sale. Due to illness and age present owners want to retire and settle an estate. Any reasonable offer considered.
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Fully equipped, now operating, good accounts. Opportunity for experienced foundryman. Will accept low down payment. Located in large Arizona City.
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Combination gas and
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Shell Molding Machine and Accessories, Shell Core Machine. Address: Box 876, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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TEXAS STEEL COMPANY
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19" cyl. or larger Jolt Pin Squeeze Lift
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1 roll-on roll-off, 1 straight
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Blast Cleaning Room, Air or Airless. Must be large size. Address: Box 883, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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1 International Core Blowing Machine B.S. 11—Condition excellent.
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Approximately 195—17⅞" x 17⅞" Burr Aluminum bottom boards. Never used! We made the wrong size. Will sacrifice. Write: BURR ALUMINUM PRODUCTS, Box 61, Burr Oak, Michigan.

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Pangborn Model MS614NF-522 Mechanical Blast Cleaning Room with dust collecting system; Room size: 15' x 35' x 10' 1½" high.

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OSBORN—Rebuilt #275-J Jolt Squeeze Molding Machines
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Automatic 14,000 # capacity low lift electric platform truck, brand new—unused surplus. Factory Price $13,000.00—Our Price $4800.00 With new unconditional guarantee.

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1 International, 600 x 8 Jolt Ram Air Pin Lift Machine
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1 Simplicity Portable Sand Conditioner, 24x36 comp/w 3 hp motor, 220v, 60 cy, manual starter, Model C—$700.00
1 Porbeck Oven, 3 drawer, 1 side opening, 350,000 btu per hr. automatic control—$700.00
1 21 x 29 Aluminum match plate flask, 5" cope, 5" drag
1 Aluminum melting furnace 550# capacity, #2 Maxom Premix unit, ¼ 220 v, 3 phase motor—$100.00
2 #12 Maxon Premix Units ¼ 220v, 3 phase motor, all units 3400 rpm

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6500 ROOSEVELT ROAD
ALLEN PARK, MICHIGAN

FOUNDRY LIQUIDATION

2—Simplicity 2' x 3' screening—aerating units.
1—Whiting 16" radius, 54" long, 'U' type ladle.
3—Whiting 2000# 26" dia. ladles, EZ Pour gearing.
1—60" Shell Cupola w/I.R. motor-blower, constant air weight control.
1—1250S Bondactor.
1—Reda series 1000 melting furnace.
341—Sterling 14" x 20" steel flasks 5" C & D.

ASK FOR COMPLETE LISTING OF **Flasks, Rammers, Ladles & Other Miscellaneous Equipment**—Write:

THE COEUR D'ALENES COMPANY
BOX 969
WALLACE, IDAHO

FOR SALE

WHEELABRATOR Tumblast 36 x 42—$3,000.
WHEELABRATOR Cabinet—cleans pipe casting—$3,500
FLASKS 50" x 40", 12 over 24"—$50
FLASKS Round 48" x 48"—$27
PANGBORN EN2 Cabinet—$275
AMERICAN Sludge Dust Collector 2500 CFM—$500
TABOR 10" Molding Machine—$90
TABOR 10" Jolt Pin Stripper—$250
RIDDLE Gyrators 18"—$110
GYRATORS 20"—$125
4 station Magnesium Dust Collector 5600 CFM—$350
SPENCER Turbine Blower 5 HP. 150 CFM—45 oz.—$195

M. ELSTEIN
426 GRAND STREET JERSEY CITY 2, N.J.

FOR SALE

One Used #3 Unit Drive Simpson Muller. Good condition. Address: Box 881, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PUBLIC AUCTION SALE

MODERN GRAY IRON FOUNDRY

FORMERLY THE PREMISES OF

AMERICAN BRAKE SHOE CO.

1322 Main Street
Melrose Park, Ill.
(Chicago suburb)
Tuesday, May 16th
at 11:00 A.M. (C.D.T.)

Sandslinger: Beardsley & Piper Motive with Raising & Lowering Arms (New 1952).
Mullor: Model 80-A Beardsley & Piper Speedmullor—cooling equipment.
Molders: #276J Osborn Jolt Squeeze; (4) 42" x 72", 30" x 22" & 27" x 60" Davenport & International Jolt Rollovers; (2) 17" x 34" & 23" x 36" International Jolt.
Cleaning Equipment: 42" x 48" American Wheelabrator Tumblast—Skip & Elevator (New 1958) Pangborn Shot Blast Room; (2) 36" x 6' Sly Tumblers.
Cupola Equipment: #9 & #3½ Whiting Cupolas with Skips (1 New 1956). 25 & 50 HP Blowers; Whiting Charging Crane.
Core Blower: Model CB-40-B Federal San Blo—Pulsating Hopper.
Core Ovens: Maehler Horizontal/Vertical—5'x6' & 30" x 48½" openings; (2) 15' x 18' (&15') x 15' Coleman Verticals (1 New 1953).
Sand System: 10 Molders' Hoppers (6 New 1956); (8) Belt, Apron & Oscillating Conveyors. (3) 20' & 60' Bucket Elevators.
Shakeouts: (3) 4'x6' & 6'x10' Link Belt.
Air Compressor: Type XRE Size 12 x 12/19½ x 12—200 HP, Type XB, Size 12 x 16/19 x 16—150 HP & Size 7 x 10/11 x 10—60 HP Ingersoll Rands.
Tool Room: 16" x 54" Monarch Geared Head—New 1949; Drills, Milling Machines; Wood & Engine Lathes.
Cranes: 50' x 408' Steel Crane Building with 15 Ton P & H Crane; (6) 2 to 10 Ton Shaw, Electrolift, Howe & Maris OET Cranes; Monorail Hoists; 1000 Ft. American Monorail System (New 1956).
Also: Payloader & Fork Trucks—Dust Collectors & Exhausters—Hundreds of Sterling & Misc. Flasks. Core Plate. Scrap. Grinders. Scales.

Valuable Land and Buildings to Be Offered at Sale

Free illustrated circular on request
Inspection: May 10th to date of sale

INDUSTRIAL PLANTS CORPORATION

316 S. LaSalle Street
Chicago, Ill.
New York Toledo

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FOUNDRY EQUIPMENT

WHEELABRATORS

(1) 20" x 27" C/W Dust Collector—Rubber Belt
(2) 27" x 36" Rubber Belt C/W Dust Collector & S/H
(1) 27" x 36" Steel Flight C/W Dust Collector & S/H
(1) 1-A-Multi Tables W/8-19" Tables C/W/D/C
(1) Wheelabrator Skip Hoist—For 27" x 36" (Never Used)

TUMBLERS & SANDBLAST

(2) Sly Tumbling Barrels—36" Dia. x 72" Long 10 H.P. Master Mtr. 220/440
(1) Pangborn—Pressure Tank Au-11 C/W-Byr separator and Elevator

SAND SYSTEM

(1) Motive Sandslinger—1952—200 Cu. Ft. Tank Arms 11 Ft. & 4 Ft.—2 speed—1220/1800 19" Head 4" Tip Raising & Lowering units
(1) 6 Station Molder Hopper Unit—Height 20'—Width 7½ Ft.—Hoppers 7' Long—Discharge Chute to Floor 7'—Total Length 40' Complete with 24" Wide Distribution Belt & Electric Pneumatic Operated Plows—This unit is bolted construction—3 H.P. Motor AC & Gear Reducer.
(1) Troughing Belt—Conveyor—152' Long 18" Wide—Belt 10' & 12' Sections—Bolted AC-Motor & Gear Reducer.
(1) Flat Belt—Conveyor—200' Long—20" Wide—10' & 12' Section C/W AC Mtr. & Reducer.
(1) Flat Belt Conveyor 24" Wide 40' Long C/W-AC Mtr & Reducer
(5) Misc—Flat Belt & Troughing Belt—6 Ft. to 40 Ft. Long
(1) 24" Wide Flat Belt 12' Long W/Magnetic Head Pulley
(3) Bucket Elevators—48" x 24" Casings—14" x 18" Buckets—30', 45' & 60' Heights
(4) Misc. No Leak Apron Conveyors 20" Wide—6' x 12' lengths.
(1) Hewitt Robins Floatex JF11—72" x 120" 13 Ton Cap—20 HP—1800 RPM—Shaker 1000 RPM—½" Stroke
(2) Hewitt Robins—Floatex JF7—48" x 72" 2 Ton Cap. 5 HP—1800 RPM Shaker 1000 RPM—¼" Stroke.

MELTING EQUIPMENT

(1) Whiting #3½ C/W Skip Loader
(1) Whiting #9 C/W Skip Loader

CORE ROOM

(24) Adjustable Core Racks—48" Wide—72" long 60" high
(1) Maelher—Core Oven—Gas Fired—Rack Type 2 Compartments (2) Racks Each—Also Unit has (6) Compartments—Shelf Type 48" x 30" x 30" For Day Work Core.
(2) San Blo—CB-40-B Complete with Pulsating Unit—w/Extra New Head
(1) Redford #1 Bench Type Core Blower C/W Air Clamps and 6 Cartridges (Never Used)
(2) Redford #2—5# Cores—26" x 30" Table 12" Core box height W/2 Heads (Never Used)

MOLDING MACHINES

(1) Tabor-Jolt-Rollover Portable Size 22-Cap.-600# Air Clamps 10" Draw Table 22" x 42"
(8) Osborn #275J—Portable—Jolt Squeeze 10" Cylinder 400# Cap—Table 16" x 20"
(2) Osborn #7012-Jolt-Squeeze Pinlift Table 21¼" x 24" 6" Draw—12" Cylinder—Cap—750#
(1) Osborn 75J—Portable—Jolt-Squeeze 10" Cylinder 500# Cap—Table 16" x 20"
(2) Tabor—Jolt—Top Squeeze 10" Cylinder 500# Cap. Table 16" x 19"
(1) Davenport — JS-10-Plain Jolt — 3000# Cap.—Table 42" x 48".
(1) Johnston & Jennings—Jolt Squeeze Portable 12" Cylinder—Cap—750#—Table 18" x 22".
(1) Milwaukee—125—3A Jolt Squeeze Pin Lift—8" Draw—12" Cylinder—Cap—1200# Table—21" x 27".
(1) Davenport Jolt Rollover—24" x 38" Pattern Draw 12" Cap—1000#—With Air Clamps.

Send us your requirements—List your surplus equipment with—

Phone ES-8-5648

FOUNDRY ASSOCIATES

927 S. Cicero
Chicago 44, Illinois

For More Information Circle 868, Page 39

• FOR SALE

C. GREENE EQUIPMENT CORP.

GOOD USED FOUNDRY EQUIPMENT

SPO Jolt, Pin Lift, model 3072
SPO Jolt, Squeeze Pin Lift, model 2138C
SPO Model 9546 Jolt, squeeze, rollover draw
Simpson No. 1 UD Muller
Simpson No. 1½ UD Muller
Simpson No. 3 Enclosed gear Muller
Simpson No. 1 Open gear Muller
J & J Model 918 Rollover
International Model 30x8 Rollovers
International Model 24x10 Rollovers
International Jolt pin lifts all sizes
J & J Model 8128 Jolt pin Lifts Table 30x38
SPO Rollover pattern draw Model RD 6815 table 36 x 68 draw 15"
International plain jolt machines all sizes
International core blowers all sizes
Champion core blower Model CB 10
International hand operated pin push ups
Pangborn Table cleaning machine Model LG6 with 6' table and 24" aux. tables complete with Dust Collector
Ingersoll-Rand 100 hp Air Compressor
Air Compressors 25 hp.
Whiting coal pulverizer Model 30 complete
Whiting coal pulverizer Model 30A complete
Dust Collectors many sizes
Fisher Aluminum Melting Furnaces 1000 lb cap.
Fisher Aluminum Melting furnace 300 lb. cap. motorized nose pour gas fired
Bondactor Model 1000L
Tessmer sprue cutters
Hough Payloaders Model HA ½ yard
Tractomotive payloader ¾ yd. cap.
Air hoists 1000 lb. to 4000 lb.
Ladles all sizes
Steel flasks all sizes
Core ovens all sizes
Beardsley & Piper Tractor type slinger

Many More Items Available

WE SOLICIT YOUR INQUIRIES

WE BUY WE SELL WE TRADE

C. GREENE EQUIPMENT CORP.
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CHICAGO 23, ILLINOIS
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ELECTRIC ARC FURNACE

Lectromelt "More Rapid" Electric Arc Furnace, 2 ton capacity. Top charge. Swing hood. With transformers and controls. Late model. Or will lease furnace and property.

MELTING CORP. OF AMERICA
OSTEND & RIDGELY STS. BALTIMORE, MD.
LEXINGTON 9-1980

FOR SALE

Reconditioned Wheelabrator & Pangborn blast machines, dust collectors, swing and stand grinders. Complete brass and aluminum foundry.

R. L. MARKEE
METAL FINISH & EQUIPMENT INC.
4509 N. 126th ST. BUTLER, WISCONSIN
SPRING 4-0208 or SUNSET 1-3420

FOR SALE

THE FOLLOWING ITEMS ARE FROM A FOUNDRY WHICH NEVER GOT INTO OPERATION!

One—Melting Furnace — Reda — Model 550-CS Complete with blower, motors, etc. Never used, still mounted on the delivery skids! Price $2500.00 F.O.B. Tucumcari.
One—Blodgett oven, Type 147, Price $500.00.
Twenty-four—size 16 x 20 x 6 inch deep never used flasks.
Fifty-five—size 20 x 20 x 6 inch deep never used flasks. Factory price new around $50.00 each—we'll take $35.00 ea. F.O.B. Tucumcari, New Mexico.

Many more parts for foundries, including several dozen never used soil pipe molds. Many melting pots, blowers, fittings, tables, jigs, burners, etc. are available. Will sell complete outfit for $7500.00 F.O.B. Tucumcari.

WRITE . . . OR . . . CALL
MR. M. S. DICKINSON P. O. BOX CC
TUCUMCARI, NEW MEXICO
PHONE: (OFFICE) 51 (HOME) 1081

PUBLIC AUCTION SALE

MODERN GRAY IRON FOUNDRY MACHINERY & EQUIPMENT ON THE PREMISES OF

YATES AMERICAN MACHINE COMPANY

729 Fourth St. Beloit, Wisc.

Thursday, May 11th at 11:00 A.M. (CDT)

B & P MOTIVE SPEEDSLINGER 22" x 5" head, Riding Type.
B & P #60 Speed Muller.
B & P #40 Speed Muller.
B & P #40 Preparator.
PANGBORN 88" Double Swingout table, Airless blast.
SIMPSON #1½ U.D. Muller.
PANGBORN 36" x 30" Tumblast.
48" x 109" Car Bottom Annealing Furnace 2300 degree.
40 ft. Bucket Elevator (New 1960).
25 ft Bucket Elevator.
16" x 11' Permanent Magnetic Belt Conveyor.
B & P CB #10 Core Blower.
INTERNATIONAL RJ Rollover.
WADSWORTH Stock Core Machine.
(2) U. S. #65 D.E. Grinders.
YALE 6000# Charge Crane, floor control.
Laboratory Equipment.
Ladles.
HOUGH Model HA Payloaders.
DINGS 39" and 45" Electric Magnets.
HAYWARD Electric Clam Shell.
FAIRBANKS 11,250# Charge Scale.
INTERNATIONAL 30 x 12 Type G Molding Machines.
SPO Pin Lifts.
HERMAN Charge Conveyor Rollover Draw 46" x 112", 56" draw with rollout line.
SIMPLICITY 4 x 8 Ring Type Crushing Screen.
SIMPLICITY Portable Sand Conditioner.
SIMPLICITY 6' x 8' Shakeout with dust hood.
SIMPSON 18" Lab. Muller.

MANY OTHER ITEMS

Inspection May 8th to date of sale

Free Illustrated Auction brochure on request

INDUSTRIAL PLANTS CORPORATION

316 So. LaSalle Street
Chicago 4, Illinois

NEW YORK TOLEDO

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. . . . a trademark to remember . . . . a name to trust . . . . .

FOUNDRY ENGINEERING SERVICE

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FOUNDRY EQUIPMENT BY FOUNDRYMEN

HAMLIN-NAGEL, INCORPORATED

Box 192, EDWARDSVILLE, ILLINOIS, *In Metropolitan St. Louis*, PHONE 3864

SAND SLINGERS
B & P Tractor type, 6' jib, 4' ram arm, 18" head
B & P Stationary Type 6' Jib, 4' Ram Arm, 18" head, 25 HP

MECHANIZED MOLDING SYSTEM
Jeffrey 16 station Overhead Sand System, includes sand storage, muller, mold conveyor, shakeout and sand return.

JOLT SQUEEZERS
Osborn 275J
International LJS 10"—12"
International PJS 16"
Tabor Top Squeeze 10"
SPO 110J—113J
Champion 10"
Milwaukee 104-5—10"—12"
SPO 2136

JOLT SQUEEZE PIN LIFT
Milwaukee 126 Portable 21 x 27 Table 8" Draw
Milwaukee 145 24 x 30 Table 8" Draw
Osborn 712 18 x 28 Table 6" Draw

International PK18 18" Sq. Cyl 8" Draw 24 x 36 Table

JOLT ROLLOVER DRAW
International "G" 30 x 12
International "F" 45 x 72 x 16" Draw
J&J 612, 25 x 30 x 8" Draw
J&J 815, 30 x 40 x 15" Draw
J&J 918, 44 x 54 table, 18" Draw
Osborn 405 39 x 63 table
Osborn 242W
SPO 508, 28 x 30 x 9" Draw
Tabor 30 x 50 x 12" Draw Shockless

JOLT PIN LIFT
Davenport 34A, 36 x 46 x 12" Draw
J&J 1216S, 36 x 54 x 16" Draw
J&J 68S, 24 x 30 x 6" Draw
Milwaukee 1536, 32 x 38 x 10" Draw
Osborn 558 20" x 24" x 5" Draw
SPO 3070

JOLT SQUEEZE ROLLOVER DRAW

SPO 9546, 30 x 40 Flask 11" Draw
SPO 920, 32 x 44 Flask 11" Draw
Osborn 332, 26 x 36 Flask 9" Draw

PLAIN JOLTERS
J&J 72 x 72
Tabor 48" x 60"

SAND MULLERS
Simpson Lab Muller
Simpson Portomuller
Simpson 1½ UD w/or w/o skip hoist
Simpson No. 1, Style "H"
Simpson #2 w/skip (open gear)
Simpson #2 UD w/aerator and skip hoist
Simpson #3 UD auto-cycle, dust hood, etc.
B&P No. 3½ Mulbaro
B&P #60 w or w/o Multromatic
Clearfield #404
Clearfield 610
Clearfield 920 w/skip
B&P 50 with skip hoist, cooling and water meter
Simpson No. 3, Style C, enclosed gear with skip hoist.

SAND CONDITIONERS
B&P Screenerators, M. L.
B&P Junior Night Gang
50" Molders Friend
Royer NDP, Royer NC2, Royer JR
American Sand Cutter, various sizes
B&P No. 60 Preparator
3 Newaygo Handy Sandys HS7GT
1 Reddy Sandy

SHAKEOUTS
Allis Chalmers 4 x 6
Simplicity 3 x 5
Newaygo Reddy Sandy
Allis Chalmers 8 x 10
Simplicity 4 x 6
Simplicity 4 x 8

CORE BLOWERS
Redford No. 1 and No. 2
Champion, CB15, CB18
Demmler No. 55, 1, 2K, 3E
Hansberg Shooter
Demmler 103EO w/feeder skip hoist, semi-auto cycle
Ross Vibra—Draws
Federal San Blo Pulsator, Model L40P1LPP
B&P Flexiblo, Model No. CB-10-DH w/ Universal Blo Plate

CORE OVENS
Tower oven, various sizes
Batch type, core & mold drying, various sizes
Porbeck 16-2B double and single end five drawer
Foundry Equipment, single end, 5 drawer
Porbeck C3C Double End and Single End, Oil Fired

CUPOLAS
Whiting Nos. 0, 2½, 4, 7, 9, 10
Cupola Blowers, various sizes
Modern swivel charger
Hauck cupola lighter
Series 1000 Bondactor
Cupoliner Model 1500

LADLES AND POURING DEVICES
Modern, Whiting, all sizes plus mixing ladle, electric tilt, cylindrical and tea pot lip pour

NON FERROUS FURNACES
#60 to #250 Crucible & Iron Pot Furnaces, stationary and tilt
Lindberg Fisher Electric Induction
Reda 1000# power tilt type reverberatory
Stroman 1200# Economelt gas fired
Stroman 1600#/hr. reverberatory, 1 station double chamber reverberatory
6000# Fisher Simplex reverberatory complete, gas fired
Lindberg Fisher NMP nose pour, 1000# capacity gas fired

CLEANING EQUIPMENT

48 x 72 American Wheelabrator with skip and dust collector

American #2 Multi table
42 x 48 American Wheelabrator
36 x 42 American Wheelabrator with skip & dust collector
27 x 36 American Wheelabrator with skip & dust collector
20 x 20 Air Blast Sly Barrel
No. 3 Pangborn continuous Wheelabrator with feeder & dust collector
36 x 72 Sly Tumbling Barrel, gearmotor drive
48 x 48 American Wheelabrator w/skip hoist
American N2 Multi Table 9' w/Dust Collector
American 20 x 27, with Rubber Belt

GRINDERS
Marschke 2 x 24
U. S. No. 64, variable speed
U. S. No. 65, variable speed 24"
Gardner 54" surface grinder
Mummert-Dixon Swing 15 HP 3 x 24"
Gardner 36" opposed wheel surface grinder

AIR COMPRESSORS
25 H.P. Air Cooled I.R.
100 HP XRB Ingersoll-Rand 2 stage, horizontal
175 HP XRE 2 stage, synchronous motor
30 HP Ingersoll-Rand horizontal
75 HP Ingersoll-Rand air cooled

AIR HOISTS
Ingersoll-Rand 700#, 1000#, 2000#, 4000#, and 10,000#
Curtis Air Cylinder Hoists

ELECTRIC HOISTS
P & H 500#, 1000#
Comet 500#
Cleveland 1000#
Yale 1000#, 6000#
Budgit 1000#

MATERIAL HANDLING EQUIPMENT
Hough Payloaders HA Models
Hyster Forklift 2000#
Towmotor Forklift 7000#
Baker Electric platform 6000#
D. C. Electric Clamshell 1½ Yard
Clamshell Buckets ¾ & 1 Yard
45" Bolted ECM Magnet
50" Bolted Ohio Magnet
55" Bolted Ohio Magnet
130' of 30" roller conveyor, 3½ rollers, 6" centers, 4" channels
Michigan 12B Front End Loader 39" Magnet

2—3 ton Shepard Niles overhead cab operated cranes, 47' span with runway and motor and generator.

TESTING EQUIPMENT
Pittsburgh Brinell Hardness Tester
Sand Testing Equipment
Speedy Moisture Teller
Detroit HB1 Brinell Hardness Tester

MACHINE SHOP EQUIPMENT
Cincinnati #118 automatic mill
Betts 52" Vertical Boring Mill, 2 loading arms
Bridgeport vertical milling machine
Niles Radial Drill 13" x 5' arm
American Radial Drill 14" x 7' arm
Peerless Power Hack Saws, all sizes
2 Foster turret lathes, serials 5U759 and 5U760, 21" swing, 2" spindle, 2 and 3 jaw chucks, cross-slide, coolant.

MISCELLANEOUS
Tessmer, Obermayer, Perkins ¾", 1½" blades, sprue cutters
Walker Turner all angle cutoff saw
C & P core knockout
Magnetic Pulleys
Steel Flasks
Slip Flasks, Jackets
500# Print-O-Matic Dial
American Rod Straightener Type F & H

PATTERNS FOR PRODUCT LINE
Approximately 50 matchplates and other patterns to produce a line of brass plumbing supplies, all jigs, fixtures, dies and special tooling, approximately $7000 *cost* stock finished parts on hand, National Sales distribution of products produced, list of customers and sales representatives.

WANTED! GOOD SURPLUS EQUIPMENT . . . . .

One piece or a complete foundry—ferrous or non ferrous

Universal* MACHINERY AND EQUIPMENT CO.

. . . large enough to serve you, small enough to know you.

1632 North Ninth Street
Reading, Pa., Franklin 3-5103

• AIR COMPRESSORS
75 hp INGERSOLL-RAND water cooled, horizontal
100 hp WORTHINGTON air cooled, 2 stage

• BLOWERS
CENTRIFUGAL 5 Hp to 30 Hp
GE, WILBRAHAM—GREEN FISHER Positive Pressure & Cent., Cupola Blowers

• BLAST CLEANING EQUIPMENT

Over 80 rebuilt Wheelabrator units sold in less than two years.

15" Cont. WHEELABRATOR Tumblast
26" Cont. WHEELABRATOR Tumblast
15" x 20" WHEELABRATOR Tumblast
27" x 36" WHEELABRATOR Tumblast
36" x 42" WHEELABRATOR Tumblast
48" x 42" WHEELABRATOR Tumblast
48" x 48" WHEELABRATOR Tumblast
48" x 72" WHEELABRATOR Tumblast
1-A WHEELABRATOR Multi-table
72" WHEELABRATOR Swing Table
No. 2 WHEELABRATOR Multi-table
WHEELABRATOR Pipe Cleaning Cabinet
WHEELABRATOR Sheet Cleaning Cabinet, handles up to 48" wide stock
PANGBORN 8' LF Table
PANGBORN Air Blast Room 6' x 8'
6' LK PANGBORN Table Room
6' LG PANGBORN Table
9' LG PANGBORN Table
DUST COLLECTORS AND SKIP LOADERS AVAILABLE FOR ALL MACHINES

• CONVEYORS
CARRIER Oscillating, 18" W x 54' L
HEWITT-ROBINS Oscill. 18" W x 40' L
HEWITT-ROBINS Vibrating, 18" W x 10' L Model VC-1
LINK-BELT, Car type mold, 114 cars, 403' track, car size 18" x 42"
LINK-BELT Oscillating, 18" W x 13' L
SIMPLICITY 17" W x 11' L, Model OA-10-KA Feeder
SIMPLICITY 24" x 10' Feeder w/hopper, Model OA-10-JA2
Roller Conveyor—Ask for List

• CORE BLOWERS
DEMMLER #1, #2, #2A, #3K
INTERNATIONAL SB-13
OSBORN #91, #192, #91-10
SAN-BLO #40-P-1, 40# core
TACCONE #4D, 10" Draw Stroke Cyl.

• DUST COLLECTORS
COMPLETE STOCK both Bag & Wet Types, 1000 to 17000 CFM

• FURNACES
DIRECT ARC MELTING
250 lb. LECTROMELT, Side Charge
500 lb. LECTROMELT, 200 KVA trans.
1000 lb. SWINDELL
2000 lb. HEROULT
2000 lb. Swindell, 3/60 1000 KVA
1½ Ton HEROULT
11' Top Charge Furnace
INDIRECT ARC MELTING
10# DETROIT
350# DETROIT LFA
750# DETROIT LFY, Conical Shell
1000# DETROIT AA
3000# DETROIT C, 500 KVA
INDUCTION MELTING & HEATING
30 KW, ECCO Hi-freq. Vacuum Melting
30 KW, LEPEL, water cooled spark gap
35 KVA, AJAX Spark Gap, High Freq. steel
50 KW to 200 KW TOCCO Units
GAS & OIL FIRED
400# & 600# FISHERS, MNP
1000# HAUSFELD Hand Tilt, Oil fired, alum or magnesium
1—#900 JC STROMAN, gas, Like new
6000# STROMAN, gas fired
20 Gas & Oil Fired Furnaces
HEAT TREATING
4' x 4' x 10' Gas Fired Annealing
9' x 12' Car Type, gas/oil
210 KW LINDBERG conveyor box type
7' Rotary G.E. 200 K.W. 1950° F
36" x 36" West. Pit Type Electric
10" x 12" x 24" LINDBERG, 2500° F. Hyd
42" x 73' G.E. Roller Hearth, 1950° F.
36 x 96, 48 x 120, 48 x 144 gas fired
Large Stock Gas Fired Box Heat Treating Furnaces

• PIT TYPE ANNEALING
42 x 96, 42 x 120 recirculating gas fired

• GRINDERS
DOUBLE END
3 Hp HISEY WOLF 3/60/220
5 Hp U.S. Model 64, 3/60/220
7½ Hp U.S. Model 66, 3/60/440
10 Hp STANDARD 3/60/440
15 Hp MARSCHKE 220 volt
25 Hp KLING 3" dia. shaft
SWING FRAME
7½ Hp MUMMERT-DIXON 2/60/220-440
10 Hp SAFETY 24" x 3" wheel
15 Hp MARSCHKE 3/60/220-440
15 Hp MUMMERT-DIXON

• LADLES
BOTTOM POUR
MODERN, 49" x 49"
MODERN Crane Type, 55" H x 50" top
MODERN Crane Type, 60" H x 60" top
LIP POUR
WHITING 28" x 28" top dia. geared
WHITING 29" x 29" top dia. geared
WHITING 52" x 52" top dia. geared
CYLINDRICAL
WHITING, 26" L x 25" dia., 1100# iron
WHITING, 19" L x 22" dia., 600# iron
WHITING, 38" L x 28" dia., 2200# iron

• MATERIALS HANDLING
BYERS Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift, mech. dump

• OVENS
COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22' x 12' x 10'
GIRDLER Thermex Dielectric Core Oven, 15KW w/36" W mesh belt
THERMONIC Dielectric Core Oven, 18 KW, w/40" wide mesh belt

• PRESSES
40 Ton FERRACUTE Sprue Cutter 1½" stroke
125 ton R.D. WOOD Down acting, 9" stroke
NIAGARA No. 82 Punch Press

• SAND CONDITIONING
B&P Nite-Gang
B&P Screenarator, Model "M"
LINK-BELT Revivifier
ROYER, NC-2, 10-15 tons/hr, 1½ Hp
ROYER, PREPARATOR, Comb., Model NDC, 25 ton/hr scrap removal 8' x 8' hopper
ROYER, NDP, 15-25 tons/hr, 2 Hp
ROYER, "NRP," 40-60 tons/hr, 5 Hp.

• SAND SLINGERS
B&P Stationary, Single Speed
B&P Tractor Type 16" Head
B&P Tractor Type 19" Head
B & P Motive Speed slinger, 2 speed, 22" head, 5" tip

• TESTING MACHINES
3000 Kg Gogan Brinell Testers

TOCCO SALE
INDUCTION HEATING UNITS
2—50 KW TOCCO 9600 cycle, 100 Hp motor
3—50 KW TOCCO JR. 2 station, 9600 cycle, 90 Hp motor
2—80 KW TOCCO JR. 2 station, 9600 cycle, 140 Hp motor
4—100 KW TOCCO JR. 2 station, 9600 cycle, 175 Hp motor
2—200 KW TOCCO JR. 1 station, 3000 cycle, 310 Hp motor

• MOLDING MACHINES
JOLT ROLLOVER PATTERN DRAW
DAVENPORT #408A, 40" x 60" table,
HERMAN 10,000# 48" x 109" table
HERMAN 6000#, 42" x 78"
HERMAN 7500#, 40" x 50" table
HERMAN 3000#, 30" x 66" table
HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type
HERMAN 1500#, 30" x 48" table
INTERNATIONAL 27" x 16", Type F, 22" x 64" table
INTERNATIONAL 31" x 16", Type F, 28" x 78" table
INTERNATIONAL 30" x 12", Type G, 28" x 33" table
INTERNATIONAL 13" x 17" table
INTERNATIONAL 43" x 16", type F, 42" x 72" table
OSBORN #243-W, 35" x 40"
OSBORN #602, 36" x 26", 900#
OSBORN #405, 3000#, flask 64" x 57"
TABOR 40" x 60", 1500 & 3000#
TABOR 22" x 42" pattern draw shockless, portable 600#
TABOR 20" x 30", w/air clamps, 1000#
TABOR 14" x 16" Rockover 150#
TABOR 40" x 50" table, 3000# capacity
PLAIN JOLT
INTERNATIONAL, 3' x 4' Table, 12" cylinder
TABOR 3' x 4' table
JOLT PIN LIFT
HERMAN #1317, 22" x 30" table
SPO #3058, 23" x 27" table
SPO #305, 750 lb. 20" x 27" table
TABOR 20" x 24" table, 600#
JOLT SQUEEZE PIN LIFT
INTERNATIONAL PKL, 20" x 28" table, 14" sq. 5½" draw
INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
MILWAUKEE #163, 15" x 24" table, 11" sq., 1500#
MILWAUKEE #165, 24" x 30" table, 16" sq., 1700#
NICHOLLS 18-44, 6½" draw
OSBORN, #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
OSBORN #716 PJ, 22" x 34" table 16" sq., 8" draw
SPO #2114P, 21" x 27" table, 600#
SPO #2116, 21" x 27" table, 11" sq., 6" draw
JOLT SQUEEZERS
INTERNATIONAL #12 LJS, 16" x 20"
OSBORN #275J, 16" x 20" table, 400#
SPO #110J, 17" x 20" table, 400#
MILWAUKEE #104-5, 17" x 21" table
SPO 113PJ, 18¼" x 26" table
TABOR Squeeze-in Head, 16" x 19" table
TABOR Yoke Type, 18" x 26" table

• MULLERS AND MIXERS
B&P #30 Speedmuller w/skip, 3 cu. ft.
B&P #40 Speedmuller w/skip, 5 cu. ft.
B&P Conventional, SIMPSON type, 87½" Dia., arranged for cooling
B & P #70 Speedmuller, 15 cu. ft. w/cooling.
CLEARFIELD #920, 9' dia., 30 cu. ft.
CLEARFIELD #610, 6' dia., 14 cu. ft.
SIMPSON, #0, U.D., 3' Dia.
SIMPSON #1, U.D., 4' dia., 4 cu. ft.
SIMPSON #1, Sep. Dr., 4' dia., 4 cu. ft.
SIMPSON, #1½, U.D., 4'6" dia., 6 cu. ft.
SIMPSON #1½, Sep. Dr., 4'6" dia., 6 cu. ft.
SIMPSON #2, enc. gear or open gear, 6' dia., 14 cu. ft.
SIMPSON #3, 8' Dia. Sep. Dr., 30 cu. ft.
WHIRLMIX, 31" dia., 200 to 300 lb. sand

• SHAKEOUTS
2' x 10' HEWITT-ROBINS
3' x 10' SIMPLICITY
4' x 5' SIMPLICITY
4' x 6' SIMPLICITY
4' x 8' SIMPLICITY
5' x 6' HEWITT-ROBINS

• TRANSFORMERS (Furnace)
100 KVA KUHLMAN 13,200, 1/60
250 KVA WESTINGHOUSE 6600, 3/60
300 KVA WAGNER 4600, 1/60
500 KVA KUHLMAN 13,200, 1/60
800 KVA PENNA, 23,000, 3/60
1000 KVA WESTINGHOUSE 23,000, 3/60
1000 KVA G.E. 13,200, 3/60
2000 KVA WESTINGHOUSE 13,200, 3/60
5000 KVA WESTINGHOUSE 2300, 3/60
7500 KVA PENNA, 13,200, 3/60

• MISCELLANEOUS
BLASTCRETE Model PM-1 Cupola Gun
FLASKS, CORE PLATES, All Sizes
CLIMAX Model 2-A Wire Straightener
45" Magnet 230V. D. C.
SLY Rd. Tumb. Barrels 68" x 32", 48" x 36"
MOULDER'S Hoppers, Various Sizes
TABOR 10 HP Cut-off Saw

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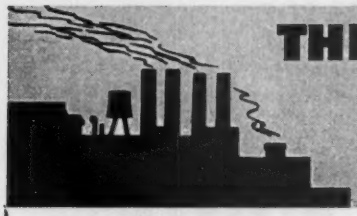

THE ACME bargain page

AERATOR
NEWAYGO

BLOWERS
I.-R. 12900 cfm, 100 h.p. 220-440 V. 20 oz.
GE 10500 cfm., 20 oz., 85 h.p., 220 V.
GE 7500 cfm., 20 oz., 89.6 h.p., 220-440 V.
SPENCER 7350 cfm., 16 oz., 50 h.p.
GE Centrifugal 6200 cfm., 24 oz., 58 h.p.
6000 cfm. INGERSOLL-RAND 32 oz.
SPENCER 3500 cfm., 20 oz., 40 h.p.
SPENCER 2250 cfm., 16 oz., 15 h.p., 220
SPENCER 1350 cfm., 32 oz.
NORTH AMERICAN 1050 cfm, 16 oz.
NORTH AMERICAN 850 cfm.
500 cfm NORTH AMERICAN 12 oz.
McKee 200 cfm
2—SPENCER Turbo 50 hp 4800 cfm 24 oz.
2—SPENCER Turbo 50 hp 3600 cfm 24 oz.

CLEANING EQUIPMENT
27" x 36" American w/skip
48" x 48" AMERICAN w/skip
6' Table PANGBORN
AMERICAN #2 Tablast 8-28" tables, late
PANGBORN GD1-Airblast Barrel
20" x 27" AMERICAN
PANGBORN 53EN2 Reach in cabinets
SLY #4 Blast Mills

CONVEYORS
17' BARBER GREEN Bucket Conveyor
1500'—458 Chain w/drive, will sell all or part

CONVEYORS, OSCILLATING
24" x 40' Ajax
SIMPLICITY 18" x 24'
SYNTRON 24" x 6'
AJAX 12" x 20'6"
36" x 11' Ajax
8" x 13' Ajax

CORE BLOWERS
CB15 55# cores, Universal blow plate
DEMMLER #50
1—DEMMLER #55 w/vibratory hopper
2—DEMMLER #55 w/plain hopper
DEMMLER 2EO
DEMMLER 2K
FEDERAL "SAN-BLO" CB 40
INTERNATIONAL SB 15H, up to 150# cores. Hydraulic clamp and draw
INTERNATIONAL SB 13, up to 60# cores
6—OSBORN 193 up to 50# cores
REDFORD Bench #2 & #4

CORE GRINDERS
1—MILWAUKEE 70-9 & 70-12's

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
2—Despatch ET. Drawer Type

CORE ROLLOVERS
INTERNATIONAL REDP Rollover 12" draw
SUTTER #500

CRANES
2—WHITING 10 Ton cap. 107'3½" span, OETC Outdoor type
1—WHITING 3 Ton OETC Cupola Charge Crane, 20' span

CUPOLA GUNS
1—Bondactor #1250 and 1000

CUTOFF SAWS
UNUSED DEWALT CUTOFF SAWS for ferrous or nonferrous metals cutoff or as sprue cutters. Flush blade adapter takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & Sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting or large work. Motor swivels horizontal to vertical in yoke.

DUST COLLECTORS
PARSONS 40,000 cfm, cloth bag type
ROTOCLONE 8D 2000 cfm 5 hp

ELECTRIC MELTING FURNACES
1—DETROIT "LFA" 350# shell 13200 V.
1—DETROIT "LFC" 700# and 350# Tapered Shell 2300 V.

FURNACES
400# Fisher Motorized Tilt, Gas Fired
600# Fisher Stationary
600# Campbell Hausfeld Brass

GRINDERS, MISC.
U.S. #70 Comb. 20" disc & 20"x3"x1½" wh
GARDNER 18" single end disc.
Porter Cable BG 8 8" belt
72" Gardner Horizontal Disc
53" Hanchett Horizontal Disc
GARDNER 36" Vert Disc
BRADFORD Metalmaster 18" Disc

GRINDERS, SNAG
US #64 D.E. 20" x 3" x 10"
#5 Fox Sgl. Wh. 24" snag.
2—KLING type RT H.D. 24" x 3" x 12" D.E.
KLING H.D. 20" x 2" x 7" D.E.
5—#6 FOX Single Wheel 24" Snag
U.S. #65 D.E. 30" x 3" x 12"
STANDARD 30 hp Type 50—30" x 5"

GRINDERS, SWING FRAME
FOX 24" x 3" x 12", 15 h.p.
MARSCHKE 24" x 3" x 12" 20 h.p., 220 V.
U. S. 24" x 3" x 12" 15 h.p., 220-440 V.
2—MARSCHKE 3 p.h., 12" wheel
1—B&D 7½ h.p.

HEAT TREATING FURNACES
G. E. Elevator Type 1950° Atmosphere Generator 65" x 16' car. Electric. Late
G. E. Elevator type 2150°—96" x 144" car atmosphere generator. Electric. Late
3—ABBOTT 24" H x 22" Deep x 30" Wide, Gas Fired
HOLDEN #202 1850° Bright Hardening Annealing
25 KW Westinghouse 2000°

HOISTS
6000# Cleveland w/monotractor travel
6000# Electrolift
15—INGERSOLL-RAND 500# to 6000#
4—2000# R. & M.
1—500# Ingersoll-Rand LC-4

INDUCTION MELTING EQUIPMENT
30 KW Lepel Spark Gap
35 KW Ajax Tama Wyatt, 60 cycle induction holding furnaces
1000# Ajax Spare Melting Furnaces

LADLES and POURING DEVICES
WHITING 16000# Crane
WHITING 5000# Crane
4000# Industrial Holding
WHITING 28 x 28—2300# Iron
MODERN 1000#—Geared Covered Crane
9—MODERN FA9 Pouring Devices 2000# cap.

MOLD BLOWER
TACONNE TD4 24" x 32" flask

MOLD CONVEYOR
366'—51—44" x 66" cars

MOLDING MACHINES
JOLT SQUEEZE PIN LIFT
8—MILWAUKEE 2646 Jolt Squeeze Strip rolloff—rolling molding machines 10" jolt cylinder; 1800# capacity, 26" Squeeze cylinder; 13" draw. Flask size 25¼" to 29" wide, 52" long. FACTORY REBUILT.
2—MILWAUKEE 165, 24" x 30", 8" draw
MILWAUKEE No. 145-2, 27" x 30" table
8—OSBORN 712 PJ 18" x 28" table
1—CHAMPION J8L10P 18" x 21" table 6" draw

JOLT SQUEEZERS
MILWAUKEE 181-7, 24" x 36" table
MILWAUKEE #162—1, 900 lbs. cap.
2—113 PJ SPO
OSBORN 275PJ
25—124 MILWAUKEE Portable Jolt Sq.
6—104 MILWAUKEE Portable Jolt Sq.
2—CHAMPION J8L10P 18" x 21" table
8—MILWAUKEE 103-5 17" x 26" table

JOLT ROLLOVER DRAWS
2—918 J & J 2000# cap. 20# draw
812 J & J 1200# cap. 12" draw
643 OSBORN 2000# cap. 20" draw
40" TABOR 2000# cap. 15" draw
30" TABOR 1000# cap. 12" draw
DAVENPORT 1248A 900# 24" x 28" table
HERMAN 3000#
2—750# HERMAN 20" x 30" table
INTERNATIONAL RJ 20" x 12"

JOLT SQUEEZE ROLLOVER DRAW
OSBORN 331-332-333
SPO 413D
INTERNATIONAL RES
SPO 9032

PLAIN JOLT
36" x 60" Herman

JOLT PIN LIFTS
1536 MILWAUKEE 1500# cap. 12" draw
1030 MILWAUKEE

MULLERS and MIXERS
3—#2 Simpson UD
#40 B & P w/skip and water meter
#60 B&P w/spare parts, mtr. & starter
1—#3 UD Simpson
1—930 Clearfield
CLEARFIELD #404
1—#2 SIMPSON OG
CLEARFIELD #610

SAND CONDITIONERS
AMERICAN 51"
ROYER NDC—ND2
SCREENARATORS S-M-L
JEFFREY Portable Sanditioner 10-15 tph

SAND SLINGERS & EQUIPMENT
3—19"—2 speed Stationary
2—14' Turntables
1—12' Turntable
4—7' Plate Feeders, 35 & 45 Tons
B & P 44-44 Speed Draw 12" draw

SAND SYSTEM EQUIPMENT
33' Newaygo Bucket Elevator 12" x 7"
28' Newaygo Bucket Elevator 12" x 7"
4—7' B&P Plate Feeders, 35 & 45 Tons
2—18" x 52' Magnetic Belt

SAWS, BAND
30" LAIDLAW, Metal Cutt.ng hydraulic

SHAKEOUTS
6' x 10' SIMPLICITY, Som—11, Spring Mounted
3' x 10' SIMPLICITY
5 x 10 LINK-BELT
4 x 8 LINK-BELT
2' x 8' Double Deck

SHELL EQUIPMENT
SHELL PROCESS 20" x 30" pattern size w/shell blender and bonding press

SPRUE CUTTERS
1—MILWAUKEE #85 TON
OBERMAYER 2 H.P.

STRAIGHTENING PRESS HYDRAULIC
225 ton Southwark
150 ton Farquhar "C" Frame
100 ton Elmes Hydraulic
100 tons Hannifin Hydraulic
60 ton Lempco 4 post
60 ton Farquhar "C" Frame
25 ton Fox
25 ton Dennison

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V
48 x 120 x 6" CHALLENGE Layout Plate & Stand
120,000# YOUNG Tensile Tester

TUMBLING BARRELS
ROTO-FINISH Model DW 45-36
SLY, 24" x 48"; 3 H.P.
SLY, 30" x 60" Duplex
30" x 60" WHITING

WOODWORKING—PATTERNSHOP
OLIVER #290 Dbl Arbor, Tilto-Arbor Saw
1—OLIVER 182D, 15" Disc Sanders
CRESCENT 24" planer
6", 8", 12" 20" and 30" Jointers
24" x 36" Band Saws

ACME

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MONA

AAA AMERICA'S FOREMOST LIQUIDATOR NOW OFFERS THE MACHINERY AND EQUIPMENT IN 2 GIGANTIC PLANTS

No. 1.

THE FOUNDRY FORMERLY OWNED BY

UNIVERSAL-RUNDLE COMPANY

BEARDSLEY & PIPER STATIONARY SPEED SLINGERS WITH PLATE FEEDERS
BEARDSLEY & PIPER STATIONARY SAND SLINGERS WITH PLATE FEEDERS
BEARDSLEY & PIPER HYDRAULIC INDEXING TURN TABLES. 22' DIA.
BEARDSLEY & PIPER #80 SPEED MULLORS
SIMPLICITY SHAKEOUTS. 5'x8' & 5'x10'
BELT CONVEYORS. SOME WITH MAGNETIC PULLEYS. THOUSANDS OF FEET AVAILABLE
BUCKET ELEVATORS—ALL SIZES
INGERSOLL RAND AIR HOISTS. 1-TON, 2-TON, 3-TON, 5-TON. SOME WITH POWER TROLLEYS
ROLLER CONVEYOR. 24", 30" AND 36" WIDTHS
SIMPLICITY OSCILLATING CONVEYOR. ALL SIZES
AMERICAN AIR FILTER ROTOCLONE #24 and #33
MOLD CAR CONVEYOR. 36 x 80" TABLES 10,000# CAP.
SAND STORAGE HOPPERS. ALL SIZES
APRON CONVEYORS AND FEEDERS
SIMPLICITY GYRATING SCREENS
JARVIS B. WEBB #458 CHAIN CONVEYOR
TACCONE MOLD BLOWING MACHINE 4' x 5' TABLE. UNUSED.
P & H 5-TON CRANES. MILL TYPE LESS THAN 10 YEARS OLD. AC VOLTAGE
INGERSOLL RAND CUPOLA BLOWER. 10,000 CFM. 125 HP
THERMO HOT BLAST HEATER. 10,000 CFM
MIXING AND POURING LADLES. ALL SIZES
P & H CHARGING CRANE. 80' SPAN 15 TON CAP. WITH A FRAME AND RUNWAYS
MILL 3-TON CUPOLA CHARGING CRANE
BESLEY #626 DOUBLE END GRINDER WITH COMPLETE AUTOMATIC SYSTEM FOR BATH TUBS
BESLEY SINGLE WHEEL EDGE GRINDER. COMPLETE AUTOMATIC SYSTEM FOR LAVATORIES.
AMERICAN WHEELABRATOR MONORAIL CABINET. 5-WHEEL UNIT. WILL CYCLE 4,000# OF STEEL GRIT PER MINUTE WITH MONORAIL CONVEYOR.
SLY AND PANGBORN SAND BLAST ROOMS
PANGBORN AND SLY DUST COLLECTORS. ALL SIZES
INGERSOLL RAND AIR COMPRESSOR 100 HP
SULLIVAN AIR COMPRESSOR 400 HP
G.E. MOTOR GENERATOR SETS 75 HP and 150 HP
ALLIS CHALMERS POWER TRANSFORMERS WITH CAPACITORS. 750 KVA
PATTERSON BALL MILLS
YOUNG BROTHERS CORE OVENS
HARDING CONICAL MILLS. ALL SIZES
SIMPLICITY VIBRATING SCREENS AND GRINDING MILLS. ALL SIZES.
AND THOUSANDS OF OTHER ITEMS TOO NUMEROUS TO MENTION, INCLUDING SAND TEST EQUIPMENT, ELECTRIC HOISTS, LATHES, DRILL PRESSES, TIME CLOCKS, LIFT TRUCKS, ETC.

THIS IS SO NEW WE DO NOT EVEN HAVE A PHONE CONNECTION AT THIS LOCATION. CALL OUR CLEVELAND OFFICES FOR FULL INFORMATION

SWeetbriar 1-3900 CLEVELAND, OHIO

Call or write for a complete illustrated brochure

No. 2

ONE OF AMERICA'S GREATEST FARM IMPLEMENT FOUNDRIES AT ROCK ISLAND, ILL.

(We are not allowed to mention the name)

CONVEYORS
LINK-BELT APRON CONVEYOR
30" x 45'
STANDARD STEEL Slat Mold Conveyor, Slats 24" x 36"
Unit 60'/ NEW 1956
LINK BELT OSCILLATING CONVEYORS
310' Roller conveyor 16", 3½" dia. rolls, 6" centers, 4" angle 1" shaft.
125' Roller Conveyor 24" wide, 2½" dia. rolls, 6" centers, 4" channels 11/16" shaft.
112' roller conveyor, 24" wide, 3½" dia. rolls, 6" centers, 4" channels 11/16" shaft.
100' approx. 28" wide x 3½" dia. rolls 6" centers, 1" shaft.

CORE BLOWERS
INTERNATIONAL Core Blower. Model SB-15-H. Complete W/Sand reservoir. Ser. #60896-1
DEMMLER CORE BLOWER Model #55. Ser. #2359. Cap.-Cores up to 3½".

CORE OVENS
DESPATCH OVEN COMPANY, Slat Conveyor Type oven. Continuous 5" wide 18" high. Length 18' x 67" high. 5 to 6' for combustion chambers & burners. Length 28'. Recirculating, air controls gas fired. Temp. 400° F. Ser. #33412.
(2) FOUNDRY EQUIPMENT COMPANY 3-Compartment. Each compartment inside 77" wide x 12' long x 78" high. Each compartment has its own gas burner equipment & recirculating equipment.
DESPATCH continuous core oven, 46' x 20' wide x 10' high. 250' of Jarvis B. Webb #678 chain conveyor with 50 carriers 4' x 5' x 6'. This unit complete w/gas burners & all controls

CUPOLAS
(2) MODERN CUPOLAS Size #8, complete w/ MODERN Swivel Type Skip Hoist Charger.

CUPOLA BLOWERS
INGERSOLL RAND CUPOLA BLOWER, TYPE FS 347, 5200 CFM, 1¼ # pressure, 3500 RPM 40 HP. 220/440 V.
New 1952. Ser. #S-347Y2. W/Foxboro.
INGERSOLL RAND CUPOLA BLOWER Type FS-554. 8700 CFM 2# pressure, 100 HP motor. 220/440 V. New 1951 W/Foxboro.
CLEANING ROOM EQUIPMENT
PANGBORN MULTI-TABLE BLAST
No. 9 LG 9' Dia. main table with (6) 36" dia. auxiliary tables. Ser. #9LG-14-475
CRANE
MORGAN 10-TON CRANE—220 V. DC 68' Span—A Frames, 16" high 240' runway, cab operated.
DING 45" MAGNET 220 V DC
HAYWARD ELECTRIC CLAM SHELL
Model #3S 1½ yd.
DUST COLLECTORS
AAF #27 ROTOCLONE TYPE W-ARR
AAF #30 ROTOCLONE TYPE W-ARR
AAF #16 ROTOCLONE TYPE D
AAF (2) #20 ROTOCLONE TYPE D
AAF #10 ROTOCLONE TYPE D

AAF MULLERS
BEARDSLEY & PIPER #70 Speedmullor, air cooled. Air bond hopper (2) air batch hoppers, starter, water meter, 100 HP motor. Ser. #70133484
BEARDSLEY & PIPER #80 SPEEDMULLOR, 24 cu. ft. 8'-6" dia. of pan with air batch hopper, water meter, dust hood, 15 HP cooling pan, air cooled. 125 HP.
SIMPSON #3 UD MULLOR WITH #3 SKIP HOIST. ALL Starter controls, dust hood, water meter, etc. Ser. #55112.

SAND SYSTEMS
MOLDING HOPPERS SAND SYSTEM (1) 24" x 190' conveyor 5' (18) molders hoppers. Hand operated gates, plow-offs

SAND SLINGERS
BEARDSLEY & PIPER Model DB STATIONARY
SAND SLINGER 4' Ramming arm. 19" head, 4" cup. 20 HP motor. 6' jib arm.
PLATE FEEDER
NEWAYGO 5-TON PLATE FEEDER. 5" dia. W5 HP motor.

FOR A COMPLETE BROCHURE OR FULL INFORMATION CALL CLEVELAND—SWeetbriar 1-3900 or ROCK ISLAND, ILL. PHONE 788-4309 ADDRESS 609 THIRD AVENUE—P. O. BOX NUMBER 836

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For More Information Circle 874, Page 39

DEPENDABLE SERVICE
QUALITY EQUIPMENT
GUARANTEED SAVINGS

PARTIAL LISTING OF EQUIPMENT NOW AVAILABLE — INQUIRIES INVITED

CUPOLA BLOWERS

MODEL	C F M	PRESSURE	HP
INGERSOLL RAND			
FS-337	3000	20 oz.	25
FS-365	4500	16 oz.	30
FS-355	6000	16 oz.	40
FS-387	10,200	20 oz.	75
FS-377	10,500	20 oz.	85
FS-565	14,100	40 oz.	200
ROOTS CONNERSVILLE			
RCR	1040	20 oz.	10
RCS	9075	32 oz.	100
SPENCER TURBO			
2025H	1850	32 oz.	25
Cont.	7500	48 oz.	150

PANGBORN LK-6' Dia Table-Room Rotoblast, Max. height of work 36", max. weight on table 5000#. Table speed 2.4 RPM. Pitless type. New 1952. Serial #6LK-5110.

SAND MULLERS

MODEL	PAN. DIA.	CAPACITY
CLEARFIELD		
404	4'	400#
610	6'	1500#

MODEL	CAPACITY	AIR COOLED
BEARDSLEY & PIPER		
30	4 cu. ft.	Yes
30	4 cu. ft.	No
60	12 cu. ft.	Yes
60	12 cu. ft.	No
70	15 cu. ft.	No
80	20 cu. ft.	Yes

ALL CAN BE EQUIPPED WITH DUST HOODS, SKIP HOIST LOADERS, MULTRAMATIC CONTROLS, ETC.

MODEL	PAN. DIA.	CAPACITY	DRIVE
SIMPSON			
0	3'	175#	Sep.
1½	4'–6"	700#	UD
2	6'	1500#	UD
2	6'	1500#	Encld.
3	8'	3000#	UD
3	8'	3000#	Encld.
3½	9'–3"	5000#	UD

ALL CAN BE EQUIPPED WITH NATL. ENG. STRAIGHT LIFT SKIP HOIST BUCKET LOADERS.

MODEL	PAN.DIA.	CAPACITY
LANCASTER		
EA4	59"	9 cu. ft.
EBG-4	59"	9 cu. ft.

JOLT SQUEEZE PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	DIA.	CAP.
PKL-12	18" x 24"	5½"	12"	600#
PKL-14	20" x 28"	5½"	14"	1000#
PK-16	20" x 30"	8"	16"	1700#
MILWAUKEE				
125	21" x 27"	8"	12"	1200#
145	24" x 30"	8"	14"	1700#
195	28" x 39"	10"	19"	3000#
196	16¾" x 39"	10"	19"	3000#
244	22" x 32"	12"	24"	3000#
245	35¼" x 42"	12"	24"	5900#
246	23¼" x 42"	12"	24"	5900#
OSBORN				
710-PJ	16" x 25"	6"	10"	500#
712-PJ	18" x 28"	6"	12"	750#
714-PJ	20" x 31"	7"	14"	1000#
716-PJ	22" x 34"	7"	16"	1250#
SPO				
2114-P	20" x 27"	4"	11"	600#
2136	21" x 30"	6"	13"	800#
2146	23" x 31"	6"	14"	1000#

JOLT SQUEEZE ROLLOVER DRAW

MODEL	TABLE SIZE	DRAW	CYL.	CAP.
MILWAUKEE				
167	32" x 33"	12"	16"	1000#
OSBORN				
332	26" x 36"	9"	16"	750#
333	32" x 45"	11"	19"	1400#
SPO				
413-C	24" x 25"	10"	13"	600#
917-A	26" x 36"	9"	17"	750#

SPECIAL!

EXCEPTIONAL PURCHASE • INGERSOLL-RAND AIR HOISTS FROM LEADING GOV'T. INSTALLATION • SAVE MORE THAN 50%

QUAN.	MODEL NO.	CAP.	PRICE
6	A	500#	259.50
5	B	1000#	279.50
17	C	2000#	439.50
21	D	4000#	539.50
13	D-6	6000#	739.50
7	E	10,000#	939.50

All equipped with top hooks for hanging; A-430 Trollies and Air Trollies, A Rail at slightly added total cost.

Discounts if purchased in quantity.

WHITING 10-TON HYDRO-ARC FURNACE

10' dia. shell, 6'-8" inside depth, 1" steel plate. Cradle tilt, manual & motorized, 9" dia. electrodes. Capacity—18 to 23 tons cupola malleable iron per hour. Holding capacity—16 tons normal, max. 21 tons.
1—ALLIS CHALMERS 2000 KVA Furnace Transformer. 12,000 volt primary, OIWC motor operated tap changer. Entire unit new 1952.

OSCILLATING CONVEYORS

MODEL	SIZE	CAPACITY in T P H
AJAX ENGINEERING (Lo-Veyor)		
LC 18-6-24	18" W x 24' L	50
LC 24-6-7	24" W x 7' L	70
LC 24-6-21 FA	24" W x 21' L	70
LC 36-6-9DA	36" W x 9' L	100
LC 36-6-14 DA	36" W x 14' L	100
HEWITT-ROBINS		
VC-6	24" W x 120' L	55
VF-3	30" W x 5' L	12
LINK-BELT		
Flexmount	8" W x 70' L	15
SIMPLICITY ENGINEERING		
OA-10-JA	24" W x 13' L	150
OA-10-JA	24" W x 11' L	150
OA-10-JA-2	30" W x 7' L	150
OA-10-JA	30" W x 13' L	100
OA-10-JA	36" W x 6' L	150
OA-10-A	36" W x 10' L	200
OA-10-A	36" W x 16' L	200
OA-10-A	36" W x 25' L	600

SANDSLINGERS

B&P Stationary, Model "DB," 5' jib arm, 4' ram, 19" head, 5" cup, 2-speed, 20/13 HP. Raising & lowering arms or fixed.

B&P Stationary, Model "DB," 8' jib arm, 4' ram, 19" head, 4" tip, 20/16 HP. Raising & lowering arms or fixed.

B&P "Motive Jr.," 11' jib arm, 4' ram, 16" head, 4" cup, R & L arms. 2-speed, 20/13 HP.

B&P "Motive," 15' jib arm, 9' ram, 2-speed, 25/16 HP. With Raising & Lowering

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NEWAYGO 8HS4-GT Super Handy Sandy, Twin Hopper, 25 cu. ft. capacity, 4' receiving hopper, 21' center elevator.
NATIONAL ENGINEERING Moulders Helper, Twin Hopper, 3000# capacity, each air operated gates.

JOLT PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	CAP.
DAVENPORT			
34 A-JS	36" x 46"	12"	2500#
INTERNATIONAL			
JDP 1200x8	24" x 26"	8"	1200#
JDP 3000x10	45" x 48"	10"	3000#
JL	32" x 52"	12"	2000#
JOHNSTON & JENNINGS			
68-SP	25" x 30"	8"	600#
812-S	30" x 38"	12"	1600#
MILWAUKEE			
1030	28" x 34"	8"	1000#
1536	32" x 38"	10"	1500#
2036	32" x 38"	10"	2000#
2542	38" x 42"	12"	3000#
3548-6	44" x 46"	12"	3000#
OSBORN			
540	32" x 52"	12"	2000#
560	32" x 45"	12"	2500#
SPO			
3070	26" x 35"	10"	1500#

JOLT ROLLOVER PATTERN DRAW

MODEL	TABLE SIZE	DRAW	CAP.
DAVENPORT			
24 SA	24" x 38"	12"	1000#
28 SA	28" x 40"	12"	1500#
34 A	34" x 58"	15"	2500#
48 A	48" x 82"	24"	6000#
INTERNATIONAL			
AN	40" x open	20"	4500#
JOHNSTON & JENNINGS			
612	24" x 30"	12"	600#
815	30" x 40"	15"	1200#
918	44" x 54"	20"	2000#
920-RC	44" x 54"	20"	2000#
1020-RC	50" x 60"	20"	3000#
OSBORN			
242-W	29" x 42"	12" to 19"	1500#
244	35" x 52"	16" to 25"	3000#
405	57" x 64"	26"	3000#
442	21" x 31"	10"	600#
601	24" x 30"	10"	900#
602	30" x 36"	12"	1200#
643	35" x 50"	20"	2000#
SPO			
505	18" x 23"	6½"	400#
506	24" x 25"	10"	600#

MODEL	TABLE SIZE	DRAW	CAP.
TABOR			
22"	22" x 32"	10"	600#
22"	22" x 42"	10"	600#
30"	30" x 40"	12"	1000#
40"	40" x 60"	15"	3000#

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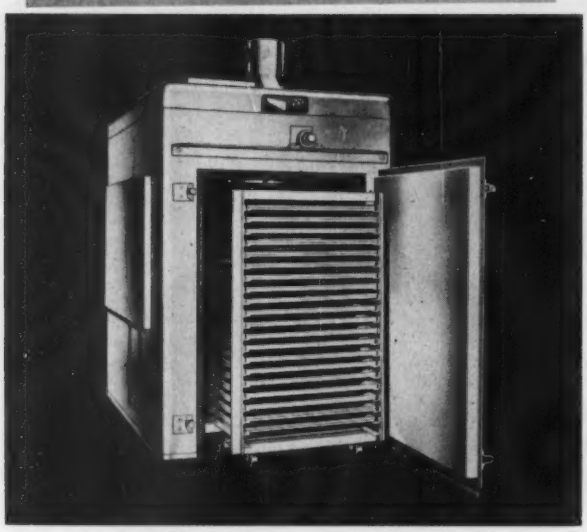

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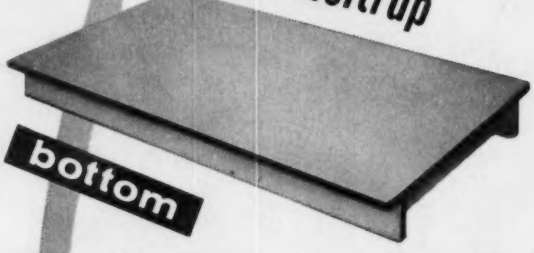

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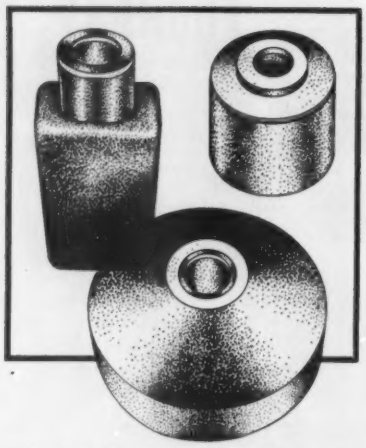

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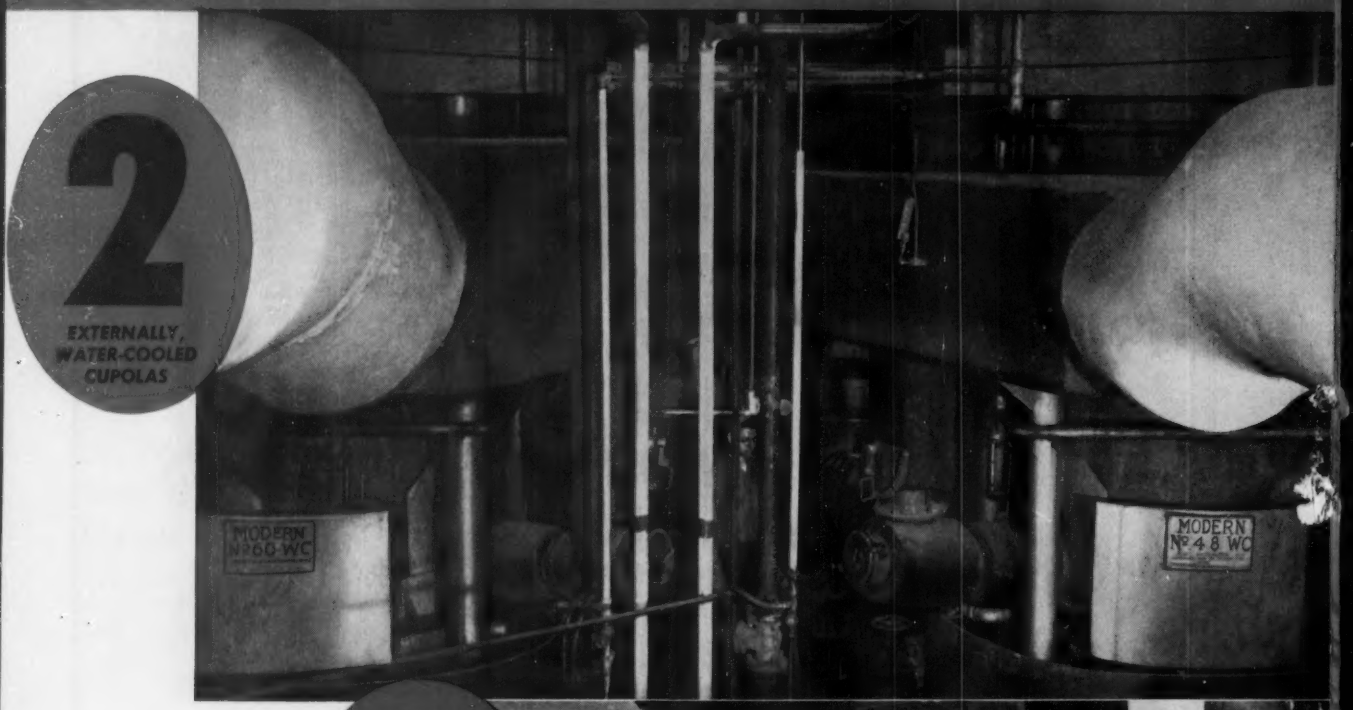

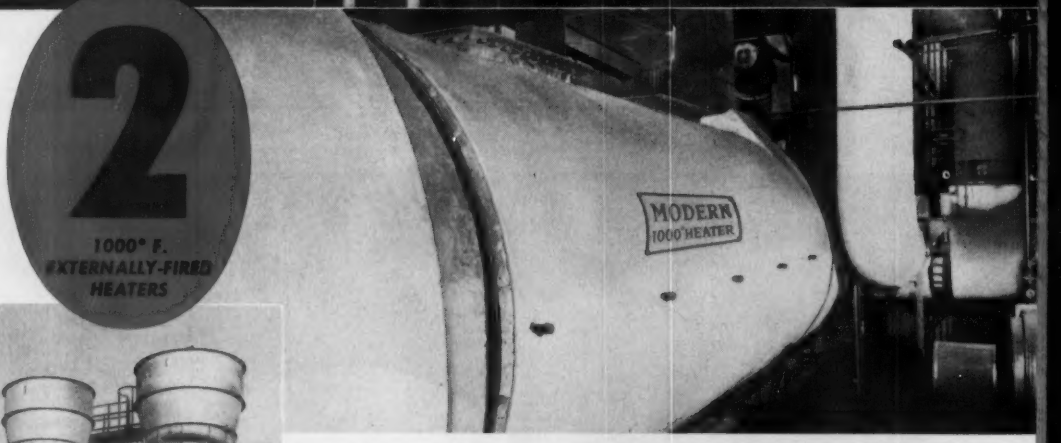

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